A SYSTEM OF MINERALOGY,

FORMED CHIEFLY

ON THE

Plan of Cronstedt.

VOL. I.

By J. G. SCHMEISSER,
F. R. S. &c.

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TO THE RIGHT HONOURABLE

CHARLES GREVILLE,

AND

Sir JOSEPH BANKS, Bart.

PRESIDENT OF THE ROYAL SOCIETY, &c. &c.

Gentlemen,

I lay the prefent Work before you with no lefs propriety than pleafure, knowing how eminent one of you ftands as the encourager and judge of the Science of Mineralogy in particular, and how eminent the other as the patron and judge of Univerfal Science; to both of you, I beg leave to acknowledge publickly,

publickly, my many obligations, as well as the honour, with which

I am,

Gentlemen,

Your obedient,

And devoted humble Servant,

J. G. SCHMEISSER.

PREFACE.

I FEEL a particular pleafure in thus laying before a candid, liberal, and difcerning Public, the fruits of my labour and ftudy, intended to improve the fcience of Mineralogy; a fcience, which, though it has been attended to by philofophers, has not, however, advanced towards perfection, with that rapidity which has characterized the progrefs

grefs of other fciences, that have been cultivated with a degree of enthufiafm, and with a fatisfaction fuch as I experienced in bringing this work to a conclufion; a work, not undertaken to anfwer interefted purpofes,—to procure emolument or fame, but to furnifh the Englifh ftudent with a correct, improved, and eafily intelligible fyftem of Mineralogy.

I hope, however, I fhall not be confidered as arrogating to myfelf more merit from this publication, than I can juftly claim. I acknowledge, with pleafure, the obligations I am under to many eminent Mineralogifts——to Wallerius, Cronftedt, Bergman, and Lametheric, for the Chemical part;——to Bruckman, for the defcription of the gems;——to Romé de Lifle, for the

Figures;

Figures;——and to Werner, and Karſten, for the deſcription of the external Characters.

I flatter myſelf, however, that thoſe who are ſkilled in this ſcience, will find that I have done more than borrow from the Authors I have mentioned; that I have ſelected what was moſt eſſential in their works, and rejected what was bad or indifferent; that I have compared their various opinions with my own; corrected errors, and ſupplied that part of Chemiſtry, without which, Mineralogy can never be ſucceſsfully ſtudied.

The Reader will therefore perceive, that the preſent publication is not merely deſigned for thoſe, who are ſatisfied with an account of the external appear-

ances

ances of minerals, but that it is particularly intended to explain the nature and utility of the ſubſtances it treats of; the better to form a rational, uſeful, and entertaining work, which it will be my particular endeavour to improve at a future period, when I hope to be able to lay before the Public, a new arrangement of Minerals, founded on ſuch principles as my own obſervations and experiments may enable me to eſtabliſh, with a view to approach nearer and nearer to the knowledge of the means which nature has employed in the formation of Minerals, and to diſcover the purpoſes for which ſhe deſigned them.

I am now to obſerve, with regard to the arrangement of the different parts of this work, that I have divided Minerals

nerals in general, into Claſſes, Genera, Species, and Varieties; though I am very ſenſible, that they do not exhibit ſuch diſtinguiſhing and conſtant marks as organized bodies.

I have introduced at the beginning of the work, Werner's external characters, and added ſuch chemical rules and obſervations, as will, I hope, enable gentlemen, not deeply read in chemiſtry, to examine or analyze ſubſtances with which they are unacquainted.

I have taken the Synonyma of ſubſtances belonging to the different Species and Varieties, from eminent Authors; from Wallerius, Cronſtedt, Born, Werner. The other Synonyma may be found

found in the laſt edition of the *Syſtema Naturæ*.

I have alſo given the names of ſubſtances in various languages, and introduced the new chemical terms, where they could be introduced with propriety, as they indicate the ſubſtances of which compounds are formed, much better than the old names. I have beſide pointed out the general marks and properties which ſubſtances exhibit belonging to certain claſſes, genera, and Species. I have given the derivations, and mentioned the inventors, of ſuch names as I could aſcertain. I have pointed out the different appearances of ſubſtances, when in a crude and manufactured ſtate, and the diſcriminative characteriſtics of minerals; their phyſical phyfical and chemical properties; the places and fituations in which they are generally found; and the ufes to which particular fubftances are, or may be, applied. Nor have I neglected to mention the curious qualities and properties of bodies, or to explain the origin of the different ftates in which Minerals are found.

At the clofe of the work, an account is given of different rocks, whofe component parts are pointed out.

I wifhed alfo to give the names of the different Authors who have written on each fubftance; but as they are fo numerous, I fhall decline doing fo at prefent; but, at a future period, as foon as leifure will admit, I fhall mention them

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in a Supplement which I propoſe to Publiſh, which will contain an arrangement of Minerals, according to a plan of my own, and an account of ſuch ſubſtances as I may have omitted in the courſe of this Work. It will alſo point out the manner of working or analyzing Minerals, a knowledge not to be expected from manufacturers, who rarely poſſeſs ſufficient chemical knowledge to enable them to extract from the ſubſtances they make uſe of, whatever they are capable of yielding.

I have now only to expreſs a hope, that this Work, of which the Second and concluding Volume will ſoon meet the Public Eye, may be reviewed by thoſe who are thoroughly acquainted with the ſubject matter of it, who, if they

they detect errors, will point out how they may be corrected, how the Work may be improved, and rendered, in a future Edition, more worthy of Public approbation.

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INTRO-

INTRODUCTION.

MINERALOGY is generally underſtood to be that branch of natural knowledge which diſtinguiſhes and deſcribes the various products of Nature which are found under or on the ſurface of the earth; and which differ from animals and vegetables, in being deſtitute of life, of a proper circulation of fluids, of propagation, and even of organic ſtructure.

The progreſs of this ſcience, though it has been cultivated for ſeveral centuries, has been very ſlow, and conſequently its utility, which regards ſo many purpoſes in common life, has been proportionally ſmall.

Perhaps we have to regret the negligence with which ſome authors have overlooked the more eſſential part of this ſcience, confining themſelves to an inveſtigation of the mere external appearance, and other imperfect marks of minerals, whilſt they were unacquainted with that part of Natural Philoſophy and Chemiſtry, ſo neceſſary in bringing forward the perfection of the ſtudy, and diſplaying its utility in the various arts.

It muſt be confeſſed, that Mineralogy would not have been even in its preſent ſtate, if fortunately a Vogel, Wallerius, Bergman, Cronſtedt, &c. who cultivated the ſtudy of Chemiſtry, had not clearly ſhewn, how much to this laſt ſcience the hiſtory of minerals was to be indebted.

To thoſe men we have to look up for many diſcoveries and improvements, which have put us in the way of rendering the ſcience more uſeful and more perfect. If mineralogiſts before or after them, had adopted the ſame plan of chemical inveſtigation, certainly many operations of nature in the mineral kingdom, ſtill unknown to us, many ores which are ſtill uninveſtigated, and which only gratify the eye of curioſity in cabinets, would have been aſcertained and deſcribed, together with the uſeful purpoſes, to which, in arts and manufactures, they might be turned.

Though much has been done, yet much remains to do; our knowledge is ſtill confined as to the formation of minerals; and all that we can learn from Nature reſpecting her operation, is limited to ſome obſervations, which are derived from examining a variety of minerals, and from comparing various phenomena, which take place under the ſurface of the earth, with ſuch reſults as occur in chemical proceſſes, and ariſe moſtly from thoſe different powers and affinities, by which different bodies act upon each other, and to which we may ſuppoſe the different

ſtates

ſtates of minerals to be owing. In order to give the reader ſome idea of affinities, I have thought proper to lay before him an account of thoſe which may have a place in the explanation of the formation of minerals.

Philoſophers have aſcertained that all homogeneous bodies have a tendency to attract each other, and to unite under certain circumſtances; this property ſolid bodies exhibit when their ſurfaces are brought into perfect contact; as, for inſtance, two perfectly level and poliſhed plates when in contact will attract each other, and will adhere by a certain power, which has been called the coheſive power; other inſtances we obſerve by the formation of large cryſtallization, ariſing from the attraction and coheſion of ſmall particles. Fluid bodies alſo exhibit the ſame, as is ſeen in two globules of mercury attracting each other even at a ſmall diſtance, and uniting.

Further, bodies of a different nature (heterogeneous) attract each other and unite, which philoſophers have diſtinguiſhed and given particular names to. Thus, when two heterogeneous ſubſtances ſimply unite into one, without ſuffering an alteration in their primitive properties, it is called affinity of mixture, or ſynthetical affinity. For example, when ſalts are diſſolved in water, or when mercury unites with lead or another metal, this is called ſimple affinity—but when ſeveral bodies unite into one, it is called compound affinity of mixture.

Many heterogenous bodies will not unite, but by the intervention of a third; for inftance, fulphur will not unite with water, but by the addition of pot-afh; zink will not unite with fulphur, but by that of iron.

In all thefe inftances, the mixed bodies remain in union, and no apparent decompofition takes place. This is called appropriate affinity. Cafes alfo occur in which one body fhows no affinity to another, except it be firft difpofed to it by means of a third; here the added body unites with the one, and the other is fet free; this is called preparative affinity: for example, fulphuric acid difcovers no affinity to lead, except it be previoufly difpofed by means of nitric acid; if lead is diffolved in nitric acid, and fulphuric acid be then added, the latter will unite with the lead, and feparate the former. In this cafe the fulphuric acid fhows even a ftronger affinity to lead than the nitric acid, though the nitric acid has prepared the laft for the combination, and was the preparative medium.

If two bodies of a different nature, one of them being a compound of two, be mixed, and a decompofition of the original compound takes place, fo that a new body is produced, and one is fet free; fuch phenomenon is called analytical affinity with fimple fynthefis. If, for inftance, cinnabar, which is a compound of mercury and fulphur,

phur, be mixed with iron, the iron will unite with the ſulphur, and the mercury will become free.

But when the two mixed bodies are both of them original compounds of two, two new bodies are produced by the mixture. This is called analytical affinity with double ſyntheſis. As for example, when kali vitriolatum and nitrate of lead be mixed together, a double decompoſition takes place, and two new bodies, namely, vitriolated lead and common nitre, are formed.

Modern philoſophers have alſo found that bodies poſſeſs very different degrees of affinity one to the other, and this property, as aſcertained by chemiſts, ſeems to follow certain laws of Nature. Thus acids acquire a different proportion of alkali and earths for ſaturation. The quantity of a certain body neceſſary to ſaturate a menſtruum or acid is in proportion to its affinity, ſuch being called the dormant or quieſcent, or latent affinity, and is expreſſed by the ſum of weight. Thus, 100 grains of ſpecific nitric acid require 215 grains of alkali for ſaturation; therefore the latter ſum expreſſes the degree of affinity of thoſe two bodies; but 100 grains of the ſame acid requiring only 40 grains of volatile alkali, the degree of affinity muſt be different.

The different dormant affinities betwixt acids and alkalies, or metals, are expreſſed in the annexed table.

The analytical affinity with ſimple ſyntheſis is therefore explained, when, for inſtance, a ſimple body A. be mixed to another body compoſed of two, namely of B. and C. by which C. becomes free, ariſing from A. having a greater affinity to B. than C.; conſequently thoſe two bodies which have the ſtrongeſt affinity to each other unite, and that which had the leaſt becomes free.

The analytical affinity with double ſyntheſis, where two new bodies are produced, is explained upon the ſame principles, or follows the ſame laws.

The following caſe will ſerve for an example; if, for inſtance, nitrate of ſilver, conſidered as a compound of A. (nitric acid) and B. (ſilver) one hundred grains of A. require 375 grains of B. for ſaturation, be mixed to muriate of pot-aſh, conſidered as a compound of C. (marine acid) and of D. (pot-aſh) one hundred grains of C. require 215 grains of D. for ſaturation, a decompoſition and compoſition take place, and two new compounds are produced, conſiſting of A. and D. and B. and C. owing to different affinity to each other; becauſe A. required only 375 grains of B. for ſaturation, and C. requires 420, therefore the analytical affinity of C. to B. exceeded the dormant of C. to B.

According to theſe phenomena, the following law has been propoſed, that a decompoſition of mixture takes place; when the analytical affinity of two bodies exceeds that of the dormant, and *vice versa.*

The analytical affinity of

420

The dormant affinity betwixt A. and B. is = 375

to

to

The dormant affinity betwixt C. and D. = 215

590 Dor.

215

And the analytical affinity of

635 Anal.

TABLE mentioning the quantities of alkalies, earths, and metallic ſubſtances, which 100 grains of the different acids are required to ſaturate; or the ſum of the different ſubſtances gives the dormant affinities betwixt acids and thoſe ſubſtances.

Sulphuric Acid,			Nitric Acid,			Muriatic Acid,		
and Pot-aſh	=	215	and Pot-aſh	=	215	and Pot-aſh	=	215
— Soda	=	165	— Soda	=	165	— Soda	=	165
— Ammonia	=	90	— Ammon.	=	87	— Ammon.	=	79
— Calcareous earth	=	110	— Calcar. Earth	=	96	— Calcar. Earth	=	89
— Magneſia	=	80	— Magn.	=	75	— Magn.	=	71
— Argillaceous Earth	=	75	— Argil. Earth	=	65	— Argil. Earth	=	55
— Baryt	=	133	— Bar.	=	128	— Bar.	=	96
— Strontion Earth	=	112	— Str.	=	94	— Str.	=	56
— Silver	=	39	— Silver	=	375	— Silver	=	420
— Tin	=	138	— Tin	=	120	— Tin	=	130
— Antimony	=	200	— Antim.	=	194	— Antim.	=	98
— Lead	=	412	— Lead	=	365	— Lead	=	400
— Mercury	=	432	— Merc.	=	416	— Merc.	=	438
— Iron	=	210	— Iron	=	255	— Iron	=	165
— Copper	=	260	— Copper	=	255	— Copper	=	265
— Arſenic	=	260	— Arſen.	=	220	— Arſen.	=	290
— Zink	=	318	— Zink	=	304	— Zink	=	312
— Biſmuth	=	250	— Biſm.	=	290	— Biſm.	=	250
— Nickel	=	220	— Nickel	=	300	— Nickel	=	310
— Cobalt	=	360	— Cobalt	=	350	— Cobalt	=	370

A know-

A knowledge of the afore-mentioned ſubject enables us to explain ſome of the operations which nature has employed in the formation of various minerals: by it we can alſo account, firſt, for the attraction and coheſion of homogeneous particles ; that power or natural tendency, without which no concrete body could exiſt. This power is often aſſiſted by other ſubſtances which poſſeſs a ſtronger affinity or adhering power to thoſe particles than the homogeneous particles did to each other ; hence the ſtate of ſuch minerals, whoſe particles are in maſſes of different degrees of hardneſs, occaſioned from an admixture of gypſum, quartz, argillaceous earth, and calx of iron, which when fluid had involved or penetrated into ſuch maſſes. From the attractive power we can account for (2.) the proceſs of cryſtallization and precipitation, when ſimple or mixed ſubſtances have been previouſly in ſolution, or in a liquid ſtate, either by a moiſt menſtruum, or by heat, and have again been ſeparated either by the mere loſs of heat, or by the diminution of the power of the menſtruum, through the intervention of another body which had a greater affinity either to the menſtruum or to the diſſolved bodies, as in caſes of precipitation, or by the mere loſs of the menſtruum, as in evaporation. In the laſt caſe bodies will exhibit their perfect regular ſhape, 1. when the particles have been ſufficiently ſeparated from each other, by a proper quantity of the menſtruum ; 2. when they

they have been gradually deprived of it, ſo that the particles have had time to attract each other, by their proper angles and ſides, by which they peculiarly adhere; 3. when they have not been deprived of that quantity of moiſture which ſome ſubſtances require to exhibit their perfect regular ſhape. But when they have been ſuddenly deprived of their menſtruum, or when the natural attraction has been interrupted by violent motion, or by the accidental preſence of another body, or by a gradual diminution of the ſubſtances contained in the ſolution, they then put on an irregular ſhape. Hence come the various modifications of the primitive figures diſcoverable in many minerals. Again, other ſubſtances, in conſequence of their gelatinous nature, will not cryſtallize on loſing their menſtruum, but will coagulate, thereby not exhibiting their natural figure, but one as impreſſed by other bodies.

(3.) By the affinities is explained alſo decompoſition, when ſimple or mixed bodies come into contact with another, which has a greater affinity to either of the component parts: This may take place either in the moiſt or dry way, according to the nature of the ſubſtances. Here one body either loſes ſome of the component parts, or unites to another (as in the proceſs of calcination, or in other caſes where new compounds are produced). Thus, for inſtance, a mixture of ſulphur and mercury (cinnabar) may

be

be decomposed by the admixture of iron, from the iron's having a greater affinity to the sulphur, when the mercury is set free, or when sulphur is united to silver or any other metal, and the sulphur comes in contact with oxygen, which has a greater affinity to the sulphur. Here a combination takes place, forming sulphuric acid, in which state it may then unite with another substance, and form another new body. In this manner decomposition and composition proceed. Again, the state of mineral bodies may originate from fusion, by means of heat, or subterraneous fire, and this last also may originate from the decomposition of other bodies containing that heat, or by the intervention of such substances as diminish the capacity for heat in some of the bodies, &c. Thus a mixture of sulphur and iron, when brought into contact with water, will decompose the water, and consequently diminish the capacity of that body for heat, which then becomes free, and more active according to the substances with which it comes into contact, and often to that degree as to burst forth in fire. Hence the variety in volcanic productions, which have undergone fusion in a greater or less degree, according to the nature of the substances.

The various colours which minerals exhibit, (1.) as to earths and stones, are to be ascribed to the quantity, state, and variety of metallic substances which unite with them during their

formation.

ſormation. (2.) As to metals, they are to be aſcribed to the different acids, or the different quantity of oxygen with which they unite. Thus copper exhibits different colours, as red, brown, black, yellow, green, blue; and lead, white, green, blue, red, and grey.

From the neceſſary union which chemiſtry ought to hold with the hiſtory of minerals, as thus ſhewn, it is deducible, that the principal object of mineralogy is not confined to a deſcription of minerals by merely mentioning their different names, the places in which they are found, and the time and circumſtances of their diſcovery; or by merely deſcribing them according to their different external appearances; or by adding a few chemical properties, when the external marks do not lead to a proper criterion; or by giving what is called their component parts, eſpecially when theſe perhaps were inveſtigated during the imperfect ſtate of chemiſtry; or laſtly, by framing an arrangement ſuited only to the convenience of a cabinet.

But the eſſence of the ſcience conſiſts in a fundamental knowledge of the conſtituent parts of minerals, aſcertained by patient inquiry, and ſo directed to uſeful purpoſes in the arts and manufactures, that inſtead of a barren nomenclature of ores, which only diſguſts the ſtudent, we come to poſſeſs that ſound ſyſtem of the

ſcience,

ſcience, which at once proves uſeful, important, rational and pleaſing.

In an Introduction to a Syſtem of Mineralogy, however foreign it might be to treat with any detail the progreſs of the ſcience, yet it ſeems neceſſary to mark the more material gradations which it has made, in order that by throwing ſome light upon former ſyſtems or arrangements of minerals, the reader may be enabled to judge of that which is the object of this work.

From the Ancients, who ſeem not to have particularly favoured this ſtudy, to modern times, we meet with ſome arrangements indeed which are ſcientific enough for the period in which they were written, others more fanciful than juſt, and a few altogether barren of much improvement upon the ſcience.

We can only mention here the methods by which authors made their arrangements, as the arrangements themſelves are to be learnt by conſulting their different works.

THEOPHRASTUS and PLINY deſcribed minerals according to the various uſes they were made of in common life.

AGRICOLA introduced ſome external marks, as colour, tranſparency, taſte, ſmell, touch, including the temperature, humidity, denſity, hardneſs, gravity, and alſo figure.

The firſt figure he called indeterminate—the 2d tabular—the 3d globular, with angular figures, as triangular, tetragon, pentagon, &c.—4th, ſuch figures as reſembled particular bodies, as capillary, lunar, horn - ſhaped, glandular, lenticular, ocular, ſtellated, &c. and he noticed alſo the appearances upon fracture.

Profeſſor HAUSEN, among the moderns, conſidered particularly the luſtre, ſtructure, and the appearance of fragments.

WALLERIUS (1747) added more external characters; and after him CARTHEUSER (1755) and BOMARE (1764).

GEHLER conſidered particularly the ſmell, ſound, taſte, touch, colour, magnitude, ſpecific gravity, hardneſs, tenacity, tranſparency, and figure.

LINNÆUS rather followed AGRICOLA's method, and dwelt particularly on the forms. Thoſe minerals which did not exhibit any particular ſhape, he called amorphous, the others, 1. priſmatic, pyramidical, lenticular, reniform; he conſidered—2. the ſurface—3. the texture —4. ſtate of particles, as compact, friable, granular—5. fibres—6. ſtructure—7. hardneſs, and —8. colour. As to cryſtals, he mentioned the number and figure of the ſides of cryſtals, reducing all to two genera; one he called priſmatic, the other cubical. He compared them, as well as the different ſhapes of minerals, with five ſalts, as natron, nitre, alum, common ſalt, and vitriol; ſuch as he could not compare with

one

one or other of these, he thought had obtained their shape from the space left by some unknown body.

CRONSTEDT appears to be the first who arranged the classes, genera, and species of minerals according to their composition and internal characteristics, and the varieties according to their external appearance: this arrangement has of late been improved by MANGELAN. Upon the constituent parts, proceeds with various degrees and improvements, the arrangement of BARON BORN (1772); of MONNET (1779); FOURCROY (1780); BERGMAN (1782); SAGE (1784); and afterwards LA METHERIE, who chiefly followed BERGMAN.

WALLERIUS, who, in the year 1788, again appeared with an improved system, in which he endeavoured to unite the external and internal characteristics; in order to arrange fossils more particularly according to the nature of the substances, he proposed in his classification the component parts, taking the external marks to assist; the order and genera to be classed according to composition, and the species according to external appearance.

Like WALLERIUS, Mr. GERHARD arranged minerals into classes and species, according to their chemical properties; taking the external ap-

appearances, particularly ſtructure and coheſion of particles, to aſſiſt when neceſſary.

PEITHNER and HILL reduced the external characters to certain diviſions, and exhibited them upon tables. PEITHNER noted ſeven columns, including, 1. colour—2. tranſparency—3. figure—4. taſte—5. ſmell—6. gravity—7. internal properties. He noticed alſo occaſionally hardneſs, ſolidity, and ſenſation to the touch. HILL adopted ſix diviſions or columns, including, 1. form—2. hardneſs,—3. gravity—4. ſurface—5. colour—6. peculiar properties. He alſo noticed occaſionally tranſparency, ſmell, taſte, &c.

1774. WERNER arranged ſpecies and varieties of minerals altogether, according to their external appearance.

1774. ROME` DE LISLE, gave the completeſt deſcription and explanation of the different cryſtallizations of minerals; and after him ABBE' HUY communicated his uſeful explanation of the method of aſcertaining the different cryſtallizations.

1784. DAUBENTON was for rejecting all ſpecies in his arrangement, as there exiſted, according to him, only varieties in minerals, which he divided into ſalts, ſulphurs, ſtones, and

and ſuch earths as are 1. unalterable in fire—2. calcareous—3. vitrifiable, &c.

From this ſlight ſketch of the means uſed by mineralogiſts for ſyſtematic arrangement, we are enabled to make ſome general reflections on the different characteriſtics which they have taken to build their ſyſtems or arrangements upon. Theſe characteriſtics are external, phyſical, chemical, and empyrical; and upon a queſtion often diſputed, which are the beſt, we have only to obſerve, that all of them, in the preſent ſtate of mineralogy, are found neceſſary, and muſt be more or leſs adopted, according to the perfection of a ſyſtem, and the fulneſs of deſcription. They are not ſufficient ſeparately to furniſh thoſe marks, by which we can diſtinguiſh all the variety of mineral products from each other.

The external characteriſtics are not always ſufficiently viſible in many ſpecimens of ores which occur to us; nor are they conſtant, as they vary according to the different operations, and accidental ſituations, to which minerals are expoſed from various ſubſtances affecting them: nor, when aſcertainable, are they always uſeful or ſatisfactory.

The phyſical and chemical properties certainly exiſt in all minerals, but they have not as yet been all ſufficiently aſcertained; as their inveſtigation is often attended with expence, from the ſcarcity

and

and ſmallneſs of ſome ſpecimens; with inceſſant labour, from the great number of all; and laſtly with uncertainty, from the difficulty of getting (by hitherto known experiments) at the ſtate and proportions of their component parts.

Of ſyſtems of mineralogy which are formed upon theſe laſt, there is much uncertainty, and perhaps ſome error. Many inſtances have occurred, in which the ſame ſpecies of minerals, analyſed by different chemiſts, has yielded a difference in the ſtate and proportion of the component parts. Indeed it requires a long experience in the operative part of chemiſtry, to perform an analyſis with accuracy, and even then we muſt be uncertain whether we have aſcertained all the conſtituent parts of the analyzed mineral, till we can re-produce the original ſubſtance, both in appearance and property, (which ſeldom happens) by re-uniting the ſeparated parts. I think we ſhould confine the name component parts to thoſe ſubſtances in which the analyſis can be proved by ſyntheſis, diſtinguiſhing all others by the terms, *ſubſtances obtained by analyſis or chemical decompoſition.*

Our knowledge is too imperfect as yet, to found a ſyſtem, which ſhall at once do away all difficulties, and ſtand the ſevere teſt of application to all minerals. But it is preſumed, that every new arrangement will proceed upon improvements, actually made by obſervations and experiments, by which no man of ſcience, whoſe ſyſtem has been in the leaſt adopted or improved, can be offended.

Whatever ſyſtem writers may frame or adopt, it is enough, that the arrangement be ſo made, that minerals which approach neareſt to each other, with regard to their eſſential characteriſtics, follow in a proper order, and are clearly deſcribed as to matter and to language.

COMPARATIVE TABLES OF EXTERNAL CHARACTERS OR APPEARANCES EXHIBITED BY MINERALS IN GENERAL.

I.

WITH RESPECT TO COLOUR.

Principal Colours, and their different Shades.

	SHADES.
WHITE.	Milk White
	Greyiſh —
	Silver —
	Greeniſh —
	Blueiſh —
	Reddiſh —
	Tin —

SHADES.

GREY.	Lead Grey Blueiſh — Soot — Yellowiſh — Blackiſh — Iron — Reddiſh — Pearl —
BLACK.	Greyiſh Black Browniſh — Blueiſh —
BLUE.	Indigo Blue Pruſſian — Royal Smalt — Violet — Sky — Lavender —
BROWN.	Reddiſh Brown Yellowiſh — Blackiſh — Chocolate —
GREEN.	Verdegreaſe Mountain Green Graſs — Leek — Pea — Apple — Yellowiſh — Olive —

YELLOW.

SHADES.

YELLOW.	Brimſtone Yellow
	Straw —
	Gold —
	Lemon —
	Clear Amber Colour
	Orange —
	Ochre —
	Wax Colour
	Candied Honey Colour
	Bell Metal Colour
RED.	Aurora Red
	Crimſon —
	Amethyſt —
	Scarlet —
	Blood Colour
	Copper Red
	Carnation or Fleſh Colour
	Peach Flower Colour
	Browniſh Red
	Roſe Colour

TABLE II.

SOLID FOSSILS.

WITH REGARD TO FIGURE,

THEY ARE FOUND,

(1.) OF COMMON SHAPE, *or of no particular form. That is, when their external appearance with regard to form, cannot be compared to any determinate figure of other known substances.*

In this case we have to observe the state or condition, whether,

1. In solid mass, spherical or angular: or, } the size.
2. Interspersed with other substances. } the size.
3. In grains, either embodied or detached, and the size.
4. Deposited upon other substances in the state of plates or mere coating, the thickness of those plates, &c.

(2.) OF PARTICULAR SHAPE. *That signifies when their form can be compared to that of another solid body, frequently obvious in common life; in this state they appear,*

Either Dentated or tooth-shaped

Wire-shaped or filamentous

Capillary

Capillary
Ramified
Tubular
Reticulated
Stalactitical or dropſtone like
Coralloid
Arboreſcent
Reniform or kidney ſhaped
Globular
Lenticular
Almond ſhape
Botryoid
Tuberculous
Cellular { 4-drangular, 6-angular, polyaedrical
ſpongy
double cellular.

OR WITH IMPRESSIONS.

That is the mark or ſpace left by other mineral ſubſtances or plants, &c.

As Cubical
Pyramidical
Cuneiform
Tabular
Perforated
Corroded

(3.) Of Regular Figure, *or Shape of Minerals, formed by Cryſtallization.*

PRIMITIVE FIGURES.

1. TRIANGLE, Plate I. Fig. 1.
2. RECTANGLE, — — 2.
3. RHOMBOID, — — — 3.

(A.) *Principal Figures, originating from the Primitive Figures.*

Dodecagon — Fig. 4.
Octagon — — — 5.
Cube — — — 6.
Pyramid, ſimple or double, as to poſition, whether erect or inclined.—Fig. 7. and 8.
Prism, with or without Pyramids.—Fig. 9. and 10.
Table or Plate, Fig. 11.
Lentil, — — 12.

By theſe we have to aſcertain,

1. The ſize or magnitude of cryſtals, or regular figures, according to the different dimenſions.
2. The degree of the ſide or end angles, aſcertained by the Goniometer. Fig. 16.

(B.) *Al-*

(a.) *Alteration of principal Figures*, (B.) *apparently produced by the Loss of Angles or Edges.*

(1.) By Truncation, which signifies when the angles or edges appear as if cut short, so that a surface is exhibited on the place of the angle or edge.—Fig. 13.

(2.) By Cuniation, which signifies that kind of alteration of primitive figure, when some or all its edges are doubly truncated, so that the oblique truncations terminate gradually in a sharp edge.—Fig. 14.

(3.) By Acumination, which signifies when the ends of a regular figure terminate in an acute or obtuse angular point.—Fig. 15.

By all these alterations we have to observe the part or place from which those alterations proceed, the magnitude or dimensions, and the form of faces.

Coherency of regular shaped Crystals.

By this we have to observe the part or place by which they adhere, either by the sides, basis, or edges.

Appearance of the Surface of Fossils.

APPEARANCES.

As to Lustre.—Whether, Metallic,
Vitreous,
Pearl,

or,

or, Resinous Lustre,
Glittering, or Dull.
Indicating the degree of intensity, which distinguishes any particular Lustre.

OTHER APPEARANCES OF SURFACES.

Whether Smooth / Rough { degree
Uneven
Granulated
Streaked in what direction, and on what sides
Reticulated, &c.

Appearances of Minerals, when fractured, or when broken.

FIRST,

As to Lustre.—*Vide the different Lustres,* *Page* 27.

SECOND,

As to the Nature of the Fractures.

Whether Even
Uneven
Earthy
Conchoidal
or, Shivery.

State

State and Condition of the Particles of a fractured Surface.

AS TO TEXTURE.

1. Whether Compact or Fibrous, and according to the dimenſions and thickneſs of the fibres.
2. Whether Lamellated or Scaly, and of what dimenſions and thickneſs.

AS TO THE DIRECTION.

Whether Straight or parallel
Curved
Undulated
Diverging, radiated
Stellated
Faſcicular
Confuſed.

AS TO THE FORM OF FRAGMENTS.

Whether Cubical
Rhomboidal
Shivery
Orbicular
Cuneiform
Pyramidical
Angular { acute / obtuſe

Columnar, as to the magnitude and number of ſides.

Granular { ſize

As

As to TRANSPARENCY. *Minerals may be Transparent, Semi-Transparent, nearly Opaque, or Opaque.*

1. TRANSPARENT, when objects can be clearly distinguished through them, when in masses or thick plates, or only when in thin plates.
2. SEMI-TRANSPARENT, when objects can be perceived, but not distinctly, through masses, or only when in thin plates.
3. NEARLY OPAQUE, when bodies possess a slight degree of semi-transparency, when held to the light.
4. OPAQUE, when bodies completely exclude the rays of light.

TRACES OR MARKS *produced on rubbing Minerals upon the Touchstone, upon Paper, or between the Fingers.*

APPEARANCE *of Particles with regard to Colour, occasioned by scraping the Surfaces of Minerals.*

HARDNESS.

According to the different Degrees.

1. Such substances, whose surfaces cannot be scratched by another Mineral, as the Diamond.

2. Scratched

2. Scratched only by diamond,	ſtrike fire with ſteel.
3. ———————— rock cryſtal,	
4. ———————— a hard knife,	
5. Scraped by a knife,	ſtrike not fire with ſteel.
6. Scratching tin, or lead,	
7. Suffering impreſſions by the nails, —	

SOLIDITY, whether malleable or brittle, and in what degree.

FLEXIBILITY.
ELASTICITY. } and the degree.

FRAGILITY. { Whether difficultly or eaſily broken, or ſplit aſunder by the preſſure of the hammer, whether difficultly or eaſily to be reduced to a fine powder.

Adheſion to the tongue } degree.

SOUND.

1. Sonorous in different degrees.
2. Creaking on friction or preſſure.
3. Crackling, &c.

SENSATION ON THE TOUCH.

Greaſy
Soapy
Rough
Cold } degree.

GRAVITY.

GRAVITY. *According to the Quantity of Weight which they loſe in diſtilled Water; which is aſcertained by weighing a ſolid Subſtance, firſt in common Air, and afterwards ſuſpending it in diſtilled Water, (of a certain Temperature) by means of a hydroſtatic Balance, and aſcertaining how much the Body has loſt of its firſt Weight, that is, the Sum of Weight which was neceſſary to bring the Scale in Equilibrium after the Subſtance was ſuſpended in Water. The Sum of its abſolute Weight is then to be divided by the Sum of Weight which the Body has loſt in Water, and the Quotient will ſhow the ſpecific Gravity.*—N. B. *It is to be obſerved, that the Mineral muſt always be weighed in a Liquid which does not act upon it; for this Purpoſe either diſtilled Water, or Spirits of Wine, or Oil of Turpentine, muſt be uſed accordingly.*

SMELL.	without friction, or when rubbed, or by breathing on them.	Urinous Sulphureous Bituminous Arſenical, &c.

TASTE.	Sweetiſh Acid Bitter Saline, &c.

CLASS

CLASS II.

Phyſical and Chemical Properties.

Attracting iron

Attracted by the magnet

Electric,	when rubbed, / —— heated,	degree.
Phoſphoreſcent,	when expoſed to the ſun, or when thrown upon red-hot charcoal or iron.	
Abſorbing moiſture	become liquid / remain dry.	

Decompoſed by air

Alteration by fire	degree.	fixed or volatile	fly off in vapour, or in inviſible particles.

Emit ſparks, when ſtruck with ſteel, or with flint,	when red-hot / —— cold.
Burn, when red hot,	colour of the flame.

Crackle, when expoſed to heat

Detonate with coals

————— nitre

Tumefy, when expoſed to heat, or to the flame of the blow-pipe.

Efferveſce by heat, with	Borax / Soda / Microcoſmic ſalt.

Melt by heat	degree of heat	by themſelves, or with other ſubſtances.

Melt into glaſs	by themſelves by different ſubſtances	degree of tranſparency	colour.

Calcine or oxydate by the aſſiſtance of heat.

——— ——— without heat.

Become hard, when expoſed to a ſtrong heat.

——— brittle, ——— ——— ———

Effervefce with	alcalies acids	degree.	

Soluble in acids.

Nitric acid, Sulphuric, Muriatic, Water, &c.	with aſſiſtance of heat, or without	quantity or proportion	colour of ſolution.

Appearance on Evaporation.

Whether Coagulate,
Cryſtallize,
or Deliqueſce.

Decompoſed by other ſubſtances.

INSTRUMENTS.

Hard knife, hard file, ſteel, hammer, a ſmall pair of tongs, microſcope or magnifying glaſs, blow-pipe, agat mortar, electrometer, magnet, touchſtone, goniometer, a ſmall ſpoon of platina, hydroſtatic, and an eſſay ſcale.

A piece of diamond, a piece of ruby, faſtened to the ends of a ſmall ſtick.

Metallic plates of	Copper Iron Tin.

Chemical

Chemical Menſtruums.

Sulphuric, nitric, muriatic, acetous, oxalic, fluoric acid, and aqua regia.

Alcalies, { aerated { vegetable and mineral,
 pure } fixed and volatile.

A ſolution of gold in aqua regia.
———————— of tin in aqua regia.
———————— lead in nitric acid.
———————— barytes in nitric and marine acid.
———————— ſilver in ſulphuric and nitric acid.
———————— ſulphate of iron.
———————— phlogiſticated alcali.
———————— ſal ammoniac.

Tincture of galls.
High rectified ſpirits of wine.
Nitre.
Calcined borax.
Microcoſmic ſalt.
Soda.
Litmus paper
Turmeric paper.

Evaporating baſins of ſtone and glaſs, funnels, filtering paper of white writing-paper freed from glue by boiling water, mattraſſes, lamp and furnace for eſſaying, &c.

CHAP. I.

CHAP. I.

MINERALS,

OR

SUBSTANCES FOUND UNDER THE SURFACE OF THE EARTH.

THEY are generally divided into FOUR different CLASSES, viz.

1. *The EARTHS.*
2. — *METALS.*
3. — *SALTS.*
4. — *INFLAMMABLE SUBSTANCES.*

There are alſo other ſubſtances, ſuch as the carbonic acid, oxygen, or the baſis of the pure air, &c. but which are inviſible, and never found in their pure or ſeparate ſtate. They are only found united to other ſubſtances, or to heat, and are neceſſary to certain ſtates of minerals; and hence, as they are found exiſting in the mineral kingdom, they ought not to be overlooked.

DEFI-

DEFINITION *of the different Subſtances which conſtitute the Minerals in general.*

CLASS I.

Of EARTHS.

Under the denomination Earth, we underſtand a concrete, friable, white, and opaque ſubſtance, which has no peculiar taſte, is inſoluble in five hundred parts of pure water, and whoſe ſpecific gravity, compared to diſtilled water, does not exceed four or five times; is fixed in fire, not inflammable, does not exhibit a metallic luſtre when melted with inflammable ſubſtances, nor produces inflammable air with acids.

There are now eight different kinds known, which differ from each other by ſome peculiar properties; five of which are known to be uſeful for ſome purpoſe or other, as the ſiliceous, argillaceous, calcareous, ponderous, and magneſia; and the other three, as the adamantine ſpar earth, circon earth, and auſtralis, have not been yet applied to any uſeful purpoſes; but future experiments may diſcover their utility.

CLASS II.

Of METALS.

Under the name Metals, we comprehend thofe original folid mineral fubftances which are diftinguifhed from all other known fimple bodies by their denfity, by their fpecific gravity, in which they exceed all other known fubftances, by their peculiar luftre, ductility, malleability, and infolubility in pure water.

In the laft century there were only eight metals known, but through the difcoveries of our modern chemifts, the number has now increafed to eighteen, which all differ from each other by fome peculiar properties.

Metals were generally divided into two claffes; perfect, and imperfect or femi-metals. Under the firft kind were underftood fuch as would admit to be brought into the ftate of thin plates, or wire, without deftroying their cohefion of particles, and which were called malleable, as gold, filver, copper, platina, iron, tin, lead. And under the femi-metals were underftood fuch as would not admit fuch operation, which were called fragil, as antimony, bifmuth, cobalt, &c.

CLASS III.

Of SALTS.

Salts in general may be diftinguifhed by their property of being perfectly foluble in lefs than 200 times their weight of pure water, and by their being more or lefs tranfparent. They alfo cryftallize, or recover their regular form, on gentle evaporation; and alfo by the peculiar fenfation which they give to the nerves of the tongue, and which is diftinguifhed by the name faline tafte.

The falts are properly to be divided in three different general claffes, as acids, alcalies, and into fuch as are compofed of the two foregoing, and which are called neutral falts.

1. Of Acids.

Acids are diftinguifhed; 1ft, by their peculiar acid tafte; 2d, by their property of changing the litmus paper or the juice of violets red; 3d, by occafioning an effervefcence with fuch earths or alcalies as contain fixed air, or carbonic acid; and by producing neutral falts with alcalies, or metallic oxyds; by decompofing milk, and the folution of foap.

2. Of Alcaline Salts.

Thefe are divided again ; 1ft, into fuch as originates (as far as we know) from vegetables, and is called *pot-afh* or *vegetable alcali*; and 2d, fuch as originates from the mineral kingdom, and is called *foda*, or *mineral alcali*; and alfo fuch as originates, or is generally produced from animal matter, and which is called *volatil alcali*, *(ammonia)* on account of its being volatile when expofed to heat. The two firft mentioned are not volatile in fire, and are therefore called fixed alcalies.

All thefe alcaline falts have the property of changing the blue juice of violets into green, and producing foap when boiled with fat or oil, to which they have an affinity. They combine with acids, and produce neutral falts when faturated with them. They have a greater affinity to acids than the earths, and therefore decompofe the folution of any earth or metals in acids, &c.

3. Neutral Salts.

Neutral Salts are fuch fubftances as are compofed of an alcali or metal faturated with acids. They fhew neither of the properties of the foregoing, becaufe both their component parts become inactive, and their variety muft be afcertained

tained by decompofing them, or by other chemical experiments.

CLASS IV.

INFLAMMABLE SUBSTANCES,

Are to be underftood fuch fubftances as will burn and be confumed in common air, fuch as the coals, &c.

CHAP.

CHAP. II.

Of the DISTINGUISHING PROPERTIES OF THE DIFFERENT *EARTHS, METALS, SALTS, &c.* Aſcertained by Chemical Experiments.

CLASS I.

Of EARTHS.

I.

CALCAREOUS EARTH.

Deſcribed by *Bergman.*

WHEN expoſed to a ſtrong heat, it is converted into quick lime.

It is ſoluble in nitric and muriatic acid, and forms deliqueſcent ſalts.

It is precipitated from the ſolution, by oxalic or by ſulphuric acid, with which it forms ſelenite.

It melts perfectly with oxyd of iron, in the proportion as 4 to 1.

It adheres ſtrongly to the tongue.

Diſſolves readily with borax, and effervеſces with alcali, when treated with the blow-pipe.

II. PON-

II.

PONDEROUS EARTH, or BARYT. Difcovered by *Sheele*, 1774.

It is foluble in diluted nitric and muriatic acid; when faturated by thefe acids, it cryftallizes, and the cryftals do not deliquefce.

It is precipitated from its folution by fulphuric acid.

Alfo by pruffiate of pot-afh.

It does not melt with oxyd of iron.

III.

MAGNESIA, or MAGNESIAN EARTH. Defcribed by *Valentine*, 1707, and by *Hoffman* and *Black*, 1755.

It is foluble in fulphuric, nitric, and muriatic acid; and forms, with the firft, fulphate of magnefia, which has a bitter tafte; and with the latter it forms deliquefcent falts, which are foluble in fpirits of wine.

It does not burn into quick lime.

It melts with borax.

And melts to a flux by oxyd of iron, in the proportion as 25 to 100.

IV.

ARGILLACEOUS EARTH. Difcovered by *Margraff*, 1780.

It is foluble in fulphuric, nitric, and marine acid, and forms alum with the firft.

It is foft to the touch.

It is precipitated from its folution by pure pot-afh.

It melts with oxyd of iron, in the proportion of 1 to 2.

Does not become ſoluble in water, when expoſed to a ſtrong heat like pure lime.

Becomes very hard by ſtrong heat.

It has hardly any affinity to carbonic acid, when found native.

V.

SILICEOUS EARTH. It is not generally acted upon by acids, except the fluoric acid, but is ſomewhat ſoluble in acids, when in the ſtate of precipitation.

It melts eaſily to glaſs, by pot-aſh.

Melts by borax without efferveſcence.

The microcoſmic ſalt hardly acts upon it.

It melts with oxyd of iron, in the proportion of 33 to 100; when in the ſtate of quartz, it ſtrikes fire with ſteel.

VI.

ZIRCON EARTH. Diſc. by *Klaproth.*

Not ſoluble in alcalies, by fuſion.

Soluble in ſulphuric acid, without efferveſcence, and exhibits a gelatinous maſs on evaporation.

Perfectly ſoluble with borax, without efferveſcence.

VII.

ADAMANTINE SPAR EARTH, CORUNDA. By *Klaproth*, in 1789.

Not ſoluble in acids.

Nor in alcalies.

VIII. AU-

VIII.

AUSTRALIS* Sidny Earth. Diſcovered by *Wedgewood.*

Is only ſoluble in muriatic acid, and is precipitated from the ſolution, by diluting it with water.

IX.

STRONTION EARTH.

Is ſoluble in marine and diluted nitric acid, it is precipitated from ſolution in thoſe acids by ſulphuric acid; when ſaturated with nitric acid, and evaporated, it cryſtallizes in hexagonal plates; with muriatic acid it forms long needle-ſhaped priſmatic cryſtals †.

CLASS II.

Of METALS.

I.

GOLD.

Its ſpecific gravity is 19,000, compared to that of diſtilled water, at 60° Fahr.

It is beſt ſoluble in aqua regia.

* So called by Prof. Blumenbach.

† I alſo found that it has different affinities to acids *(which are mentioned on the table of affinities)* and which, together with the different cryſtallization as above mentioned, lead me to offer it as a new genus of earth.

May

May be diſcovered when in a ſtate of ſolution, by adding a few drops of ſolution of tin to it, by the purple precipitate which is produced.

The ſolution leaves a purple ſpot upon the ſkin of the hands.

It is precipitated from the ſolution, by ſulphate of iron, and not by ſal ammoniac.

II.

PLATINA. Is deſcribed by *De Liſle* and *Sickingen.*

Its ſpec. grav. is = 21,000.

It is ſoluble in aqua regia.

The ſolution dyes the ſkin blackiſh.

Is not precipitated by ſulphate of iron.

Is precipitated by ſal ammoniac.

III.

SILVER. Its ſpec. gr. = 10,000.

It is readily ſoluble in nitric acid.

May be diſcovered, by a few drops of marine acid added to its ſolution, which unites with the ſilver, and ſeparates in the ſtate of a white precipitate, which has the peculiarity of becoming a blueiſh black, when expoſed to light, and eſpecially the light of the ſun.

The ſolution of ſilver in acid dyes the ſkin black.

IV. COP-

IV.

COPPER. Its ſpec. gr. = 9,000.

Is ſoluble in moſt acids.

Is diſcovered by a piece of poliſhed iron plate put into its ſolution, when the copper is recovered and depoſited upon the plate in a metallic ſtate.

Volatile alcali, or ammonia, extracts a blue colour, when digeſted with it in any ſtate.

Phlogiſticated alcali, when dropped into its ſolution in acids, produces a red precipitate.

When expoſed to the action of the blowpipe, it produces a glaſs, which firſt appears brown, and afterwards green.

V.

LEAD. Its ſpec. gr. = 11,000.

Is readily ſoluble in nitric acid.

May be diſcovered, by marine acid added to its ſolution, which produces a white precipitate, which does not change its colour, when expoſed to light, and which is ſoluble in 24 times the weight of diſtilled water.

The ſolution taſtes ſweetiſh.

When expoſed to the action of the blowpipe, produces a glaſs.

VI.

MERCURY. Its ſpec. gr. = 14,000.

Is ſoluble in nitric acid.

May

May be diſcovered by a poliſhed plate of copper placed in the ſolution, upon which the mercury will be depoſited in a metallic ſtate, ſo that the recovered particles may be diſcovered, by means of a magnifying glaſs.

VII.

TIN. Its ſpec. gr. = 7,000.

Is readily ſoluble in aqua regia.

Alſo in nitrous acid, but is ſpontaneouſly ſeparated again in the ſtate of a white calx.

May be diſcovered in the ſtate of ſolution, by adding a few drops of ſolution of gold, with which it produces a purple precipitate.

Phlogiſticated alcali dropped into its ſolution, occaſions a precipitate, which appears firſt greeniſh, but changes into blueiſh white.

VIII.

IRON. Its ſpec. gr. = 7,200.

Soluble in ſulphuric and muriatic acids, &c.

May be diſcovered on dropping a little phlogiſticated alcali into its ſolution, which produces a blue precipitate.

Cauſtic volatile alcali dropped into its ſolution produces a yellowiſh brown precipitate.

When in the metallic ſtate, is attracted by the magnet.

IX. ZINK.

IX.

ZINK. Firſt deſcribed by *Albertus Magnus*, in 1280, alſo by *Henkel & Lawſon.*

Its ſpec. gr. = 6,800.

It burns with a bluiſh green flame, when expoſed to red heat, and ſublimes in the ſtate of a white light ſubſtance.

It precipitates lead, and other metals, in a metallic ſtate, from their ſolution.

When in an oxyd ſtate, is recovered by charcoal in a cloſe veſſel.

X.

BISMUTH. Diſcovered by *Agricola* and *Schroeder*, in 1641.

Its ſpec. gr. = 9,600.

Is ſoluble in nitric acid, but ſeparates again, on diluting the ſolution with much diſtilled water.

It produces a brown glaſs, with borax, when expoſed to the action of the blow-pipe.

Phlogiſticated alcali dropped into its ſolution, produces a pale green precipitate.

XI.

ANTIMONY. Diſcovered by *Baſil. Valentine.*

Its ſpec. gr. = 6,800.

Is ſoluble in aqua regia, but is precipitated again by mere water.

Phlogiſticated alcali dropped into it, produces a blue precipitate, which changes ſoon into a deep olive green.

Tincture of galls produces a grey precipitate.

It calcines and ſublimes in the ſtate of a white powder, when expoſed to heat.

XII.

COBALT. Deſcribed firſt by *Brandt*, in 1735, and by *Lehman*.

Its ſpec. gr. = 7,700.

Is ſoluble in ſulphuric and nitric acid.

The ſolution appears of a roſe-colour.

Phlogiſticated alcali added to its ſolution, produces a blue colour; and tincture of galls, the ſame.

Pure or cauſtic pot-aſh, produces a reddiſh precipitate.

When melted with borax, produces a blue glaſs.

Diſſolved in aqua regia, makes ſympathetic ink.

XIII.

NICKEL. Deſcribed by *Cronſtedt*, in 1751, and *Bergman*.

Is ſoluble in nitric acid.

The ſolution appears deep green.

Ammonia or volatile alcali, extracts a blueiſh colour from it.

Phlo-

Phlogiſticated alcali added to its ſolution, produces an emerald green, changing gradually to a yellowiſh brown, precipitate.

A poliſhed iron plate held in its ſolution, produces no precipitate.

When melted with borax, produces a hyacinth-coloured glaſs.

XIV.

MANGANESE. Diſcovered by *Gahn*, in 1777.

Its ſpec. gr. = 6,840.

Is ſoluble in marine acid, by the addition of a little ſugar.

The ſolution appears brown.

Is diſcovered by adding a little common marine acid to it, which, by the aſſiſtance of heat, produces the ſmell of dephlogiſticated muriatic acid air.

Produces pure air, when expoſed to red heat in a cloſe veſſel.

Treated with borax, by means of the blow-pipe, produces a glaſs of a purple colour.

XV.

ARSENIC. The Metal firſt diſcovered by *Schroeder*, in 1641, and by *Monnet*, in 1773.

Its ſpec. gr. = 8,300.

May be diſcovered, by expoſing a piece of it upon red-hot coal or iron, by means of which, a garlic ſmell is emitted.

The fumes will depoſit a white coating on a plate of copper.

When phlogiſticated alcali is dropped into its ſolution, it produces a green precipitate.

XVI.

WOLFRAM. Diſcovered by *Meſſrs. de Luyarts*, in 1783.

Its ſpec. gr. is = 17,6.

Is very brittle.

Difficult to fuſe.

On ſcraping its ſurface, appears reddiſh.

It effervesces with microcoſmic ſalt, when expoſed to the action of the blow-pipe, and produces a pale red glaſs; with borax, a green, by the internal, and a red, by the external flame.

XVII.

MOLYBDENA. Diſcovered by *Hielm*, in 1784.

Its ſpec. gr. = 6,000.

It melts eaſily, is volatile by moderate heat, effervesces with alcali, and emits a ſulphureous ſmell, when treated with the blow-pipe.

Is not affected by nitric acid, except by the aſſiſtance of heat.

Scarcely

Scarcely affected by borax or microcofmic falt.

XVIII.

URANIUM. Difcovered by *Klaproth*, 1790. Its fpec. gr. = 6,440.

Soluble in nitric, fulphuric, and marine acid. Is not precipitated by zink. Phlogifticated alcali added to the folution, produces a deep red precipitate.

CLASS III.

Of ACIDS

I.

SULPHURIC ACID. This may be difcovered by adding a few drops of a folution of muriate of baryt to any liquid containing that acid, when a precipitate takes place, occafioned by the ftrong affinity of fulphuric acid to the ponderous earth; or by decompofing fubftances containing that acid, by means of pot-afh, with which it forms the vitriolated tartar.

II.

NITRIC ACID. When mixed with pot-afh, detonates upon red-hot charcoal; when in a feparate ftate, diffolves filver, &c.

III.

MURIATIC ACID. This may be diſcovered by adding a few drops of ſolution of ſulphate of ſilver to any liquid containing that acid, when a white precipitate will take place, namely, luna cornua.

IV.

PHOSPHORIC ACID. This may be diſcovered by its vitrifying and phoſphoriſing nature, when expoſed to the action of the blow-pipe.

V.

BORACIC ACID. This is ſoluble in ſpirits of wine, and burns with a green flame when kindled. It is precipitated from its combination with ſoda, as in borax by ſulphuric acid.

VI.

ARSENICAL ACID. This may be diſcovered by the ſmell of garlic which it emits when expoſed to heat.

VII.

FLUORIC ACID. This may be diſcovered by mixing a little concentrated ſulphuric acid, to a ſubſtance containing that acid, and

and expoſing it to a little heat, when vapours will be diſengaged which affect glaſs immediately.

ALCALINE SALTS.

I.

VOLATILE ALCALI or AMMONIA. This may be diſcovered by its pungent ſmell, which is produced when a ſubſtance, containing that alcali, be mixed with quick-lime or pot-aſh.

II.

SODA or MINERAL ALCALI. Decompoſes when expoſed to air, or loſes eaſily its cryſtallizing water, forming glauber ſalt with ſulphuric acid; and with other acids, it forms ſalts which do not eaſily deliqueſce.

III.

VEGETABLE ALCALI or POT-ASH. Deliqueſces when expoſed to air, and does not cryſtallize.

All theſe alcaline ſalts decompoſe ſolutions of earths and metals in acids.

CLASS I.

INCLUDING

EARTHS and STONES.

GEN. I.

ZIRKON by the GERMAN, and *JARGON* by the FRENCH.

SPEC. I.

THIS ſubſtance is found in ſmall grains, and in ſmall flat pebbles. Of various colours, viz. greeniſh, grey, reddiſh green, browniſh, and hyacinth red.

Its regular ſhape, according to Romè de Liſle, is an equal-ſided octaedron; the two pyramids are ſeparated by a ſmall priſm.

The pyramids are more obtuſe than thoſe of the diamond and ruby; it is the only kind of the gems in which the pyramids of the octaedron are ſeparated by rectangular priſms.

Its

Its specific gravity compared to distilled water at 60°, is = 44,160.

It scratches glass; is not altered in fire by that heat in which the diamond is consumed.

According to *Klaproth*, it yielded by analysis 68 grains of circonia, 31 of siliceous earths, one grain of iron.

Another chemist found it containing also a little trace of nickel.

It is found at Brasil and Ceylon.

Was first taken for a kind of diamond, but was made a peculiar genus by *Werner*.

GEN. II.

ADAMANTINE SPAR. CORRUNDUM.

Fr. *Spath Adamantin.*

Germ. *Diamant Spath.*

Its colour is generally greyish, inclining to greenish white, chocolate brown, &c.; is of a lamellated texture.

It cuts glass like diamond, and scratches other gems; strikes fire with steel; is not affected by sulphuric, nitric, or marine acid.

Its regular figure exhibits six-sided short rhomboidal prisms, rounded on the top, of a lamellated texture, shining in certain directions.

Its specific gravity = 3,710, sometimes 3,908.

Mr. *Klaproth* found it to consist of 22 parts of a peculiar earth, which he called corunda earth, of 64 argillaceous earth, a little iron and nickel.

It

It is found in Bengal, Bombay, and in China, generally in a granit mixture of mica and feld-ſpar; ſometimes accompanied with black ſhorl, or cryſtals of magnetic iron ſtone.

It is uſed for poliſhing gems, and other hard ſtones.

GEN. III.

SILICEOUS GENUS.

The ſubſtances which are included under this genus, and particularly in the firſt part, exhibit moſtly a vitreous appearance, poſſeſs a high degree of hardneſs, and for the moſt part a great degree of tranſparency; they are ſcarcely affected by any other acid than the fluoric.

They are generally compoſed of ſiliceous, argillaceous, and a little calcareous earth and oxyd of iron; they ſeldom contain oxyd of other metals, or baryt earth.

Moſt of them ſtrike fire with ſteel.

The firſt part includes chiefly the ſtones which are claſſed with the gems, and which are almoſt all electric, though in different degrees.

SPEC. I.

SAPHIRE. In Latin *Saphirus*; Greek, *σαφειρος*; Hebrew, ספהיר, (the ſtone worn by the high prieſt of the Jews.)

By

By WALLERIUS, *gemma pellucidiſſima duritie tertia colore cæruleo vel cyano, igne fugacius.*
By CRONSTEDT, *Saphirus gemma.* By Romè de Liſle, *Ruby.* The other Synonima, vide Syſt. Nat. Lin. edit. Gmel.

Its colour is ſky blue, or the ſhades of Pruſſian and indigo blue, ſeldom inclining to pink.

It loſes part of its colour by ſtrong heat.

Its ſpec. gr. = 3,780 to 4,000.

Is next in hardneſs to the diamond.

It is found in grains, in obtuſe angular pieces, in ſand and rivers; is alſo found of a rhomboidal figure.

Its regular figure is the dodecaedron, compoſed of two longiſh hexagonal pyramids, joined by their baſis. The pyramids ſometimes truncated on the points.

The cryſtals are ſtrong—ſhining; exhibit a lamellated texture, tranſverſely ſtriated. They become colourleſs when melted with microcoſmic ſalt.

Some kinds yielded by analyſis, (Bergman) 58 argillaceous, 35 ſiliceous, 0,5 calcareous earth, and 0,02 iron.

The beſt kind is very dear. A piece of 10 carats was valued at 50 guineas, and one of twenty carats, at two hundred pounds. Thoſe which come from Perſia are ſomewhat greeniſh, and very ſcarce.

Thoſe

Thoſe of an opaleſcent nature are leſs eſteemed.

The greateſt quantity come from the Eaſt Indies, from Pegu and Ceylon.

Some are found in Saxony, Bohemia, and Siberia, but are of leſs beauty and value.

If one ounce of flint glaſs is mixed with two grains of oxyd of cobalt, and melted, it produces a glaſs ſimilar to the ſaphire in colour, called falſe ſaphir.

SPEC. II.

RUBY. By CRONSTEDT, *Adamas ruber*, Carbunculus of Pliny.

By WALLER, *gemma pellucidiſſima duritie ſecunda colore rubro in igne permanente.*

VAR. I. TRUE RUBY.

Silex rubinus verus. Syſt. Nat. L. nov. edit.

By the German, *Aechter Rubin.*

Its colour is crimſon, or deep red, which it retains in fire.

It is found in angular pieces, in ſmall pebbles, and of regular ſhape, as octaedron, or in double 4-ſided, ſeldom 6-ſided, pyramids.

Its ſpec. gr. = from 3,760 to 4,283.

It yields by analyſis, 39 ſiliceous, 40 argillaceous, 9 calcareous earth, and 10 of oxyd of iron.

The

The beſt kinds are brought from the Eaſt Indies, from Pegu, Ceylon, Braſil, Calcutta, Cambaja.

Some are found of the ſhape of the Topaz of Braſil, which are ſuppoſed to be ſuch, having only been altered by fire. This can be proved, on expoſing the Topaz in a crucible with wood-aſh to a ſtrong heat, by which means it obtains that red colour. This experiment was diſcovered by Mr. Guetard, and communicated to the Royal Academy at Paris, by *Dumell*, a jeweller.

The beſt true rubies are very dear, almoſt equal to the red diamonds.

It is ſaid that Queen Elizabeth of Auſtria made a preſent of one to her brother the Emperor Rudolph, which was valued at 6000 ducats.

They are ground upon copper plates with emery, and afterwards poliſhed with tripoli; but the ſpinell is poliſhed with tripoli and ſpirit of vitriol, or diluted ſulphuric acid.

VAR. 2. SPINELL, or *Balais* by the French,

Is not quite ſo hard, differs from the other in the colour, which is inclining to roſe colour, but which is deſtroyed by a ſtrong heat, and is ſaid to contain leſs ſiliceous earth.

SPEC.

SPEC. III.

TOPAZ *. So called in moſt languages.

By WALLERIUS, *gemma pellucidiſſima duritie quarta colore aureo in igne fugace.*

By CRONSTEDT, *Topazius gemma*, and by other writers, vide Syſt. Nat. L. edit. nov. Gmel.

Its colour is various.

Thoſe from the Eaſt Indies, which are called the true oriental, are almoſt colourleſs; thoſe from Braſil exhibit the colour of the fine yellow tranſparent amber, and thoſe from Saxony yellowiſh white.

The Eaſt Indian Topazes melt eaſily with borax, and increaſe in weight when ſtrongly heated.

VAR. 1. BRASIL TOPAZ.

Its ſpecific gravity = 3,564.

It yields by analyſis, 52 of ſiliceous, 44 of argillaceous, 2 of calcareous earth, and 0,31 iron.

It ſcratches hyacinth and rock-cryſtal; though its ſurface can be ſcratched by diamond, ſaphire, and ruby, yet its primitive figure is, according to Romè de Liſle, an octaedron. It generally exhibits a four-ſided rhomboidal priſm, terminating from the ſides in flat four-ſided pyramids, longitudinally ſtriated, and of a foliaceous texture.

* From the Greek word Topazion.

That kind which is called the Pink, by the Indians, exhibits generally ſix-ſided priſms, terminating in three-ſided pyramids, the baſe of which exhibits a triangle with the points truncated.

VAR. 2. The SAXON TOPAZ, called by La Metherie *Chryſoberill,* found at Schneckenſtein, in rocks compoſed of quartz, black bar ſhorl, and lithomarge.

Its regular figure exhibits rectangular four-ſided ſhort priſms, the ſide edges truncated, the faces of the truncation are generally ſmaller than the principal ſide faces; the broad ſides deſcribe a right, and the ſmall faces, an obtuſe angle. The end terminates generally in a ſix-ſided pyramid, truncated on the point, the faces of the acumination are moſtly pentagonal, and thoſe of the truncature, hexagonal.

Is ſcratched by ſaphire; is leſs hard than the oriental. Is found in maſſes of rock cryſtal, in an inclined poſition, upon the ſurface of the matrix.

It loſes its colour entirely in fire.

It yields by analyſis (according to Bergman) 46 argillaceous, 39 ſiliceous, 0,8 calcareous earth, and 0,6 of iron.

They are ſet in rings when finely poliſhed, and alſo often in buckles, for which purpoſe they

they are firſt expoſed to heat, in order to deprive them of their colour.

SPEC. IV.

HYACINTH. So called in moſt languages, from the GREEK ὑάκινθος, λυγγούριον;
Lynkur by THEOPHRAST.
WALLER. *Topazius flave rubens.*

Its colour is a peculiar yellowiſh red. Moſt of the hyacinths retain their colour in fire. Thoſe which are of a candied honey colour are leſs eſteemed.

The hyacinths are found in the form of pebbles, in obtuſe angular pieces. Its regular figure exhibits a dodecagon with unequal rhomboidal faces. The eight faces which compoſe the two pyramids have an acute angle of 73°, and the obtuſe of 107°. The four rhombs of the priſm have their acute angle = 65° and their obtuſe = 115.

The rhombs of the priſms are ſometimes longiſh, and in that caſe their figure appears hexagonal, changing alternately with the rhombs of the pyramids.

More varieties of cryſtallization are deſcribed in *Brückman's* book, *Von den Edelgeſteinen.*

The

The cryſtals are ſmall, have a ſmooth ſurface; a lamellated texture; a high luſtre; break in indeterminate pieces, moſtly tranſparent.

Their ſpec. gr. = 3,667.

They are harder than emeralds and quartz.

When expoſed in a crucible, ſurrounded by wood aſhes, to a ſtrong heat, they loſe moſt of their colour, and are, in that ſtate, often ſold for diamonds.

The hyacinths are ſmoothened firſt upon a leaden plate with emery, and poliſhed with tripoli.

One hundred grains of hyacinths have yielded by analyſis, according to *Bergman*, 40 grains of argillaceous, 20 of calcareous earth, and 13 of oxyd of iron.

They were formerly uſed in medicine, as a ſpecific; and the electuary of hyacinths is ſtill kept by ſome apothecaries, who are ignorant enough to attribute medicinal effects to it.

They are brought from Ceylon, Peru, Arabia, Calicut, Cambaja, Nortſchinſk,—from the Uralian mountain in Siberia, and alſo from Switzerland and Bohemia.

They are imitated by heating rock-cryſtals, and putting them into a ſolution of dragons blood, or by a fuſible mixture of one ounce of flint glaſs, and 24 grains of colcathar of vitriol of iron.

VAR. 2. HYACINTHINE, or volcanic hyacinth —by *La Metherie.*

This variety is leſs hard than the real hyacinths.

Its regular ſhape exhibits a 4-ſided priſm, having the angles always truncated, which make it appear a ſuboctaedron, terminating in a 4-ſided pyramid, with pentagonal faces.

It melts eaſily, whilſt the oriental hardly melts at all.

Its colour is generally deeper than the oriental.

It is generally found in volcanic products.

SPEC. V.

AQUAMARINE, BERYL. Theſe names were promiſcuouſly given to a kind of topaz, of a mountain green colour, and were conſidered as different ſpecies, but are now aſcertained to be the ſame; the name Aquamarine ſeems to be the moſt proper on account of the colour.

It is found in Siberia.

It exhibits large perfect 6-ſided priſms.

Is alſo found in Saxony, at Johanngeorgenſtadt, in the mine called *Friſch Gluck*; but this kind differs from the Siberian in being leſs tranſparent, and in not exhibiting ſo fine a colour.

When

When rubbed it attracts light ſubſtances, as aſhes, hairs, and paper; it is not altered by the flame of the blow-pipe.

Mr. Bindheim found it contained 24 argillaceous, 8 calcareous, 64 ſiliceous earth, and $1\frac{2}{3}$ iron.

The following deſcription of the latter kind, is given by Mr. Hoffman :—

The beryls exhibit a pale mountain green colour; adhere by the ſide faces to the matrix, which ſhines through the cryſtals. The cryſtals always exhibit a 6-ſided priſm on a ſteatitical matrix, and are of various ſizes. The ſurface is longitudinally ſtriated, a little ſhining, of a lamellated texture; when tranſverſely broken, ſemitranſparent, and brittle.

Spec. VI.

EMERALD. *Smaragdus*, from the Greek word σμαραγδος σμαρασσω, ſhining, reflecting.

By the German *Smaragd*; in French *Emeraude*.

Waller. *gemma pellucidiſſima duritie ſexta colore viridi ſubflavo*, &c.

Cronstedt, *Topazius Chryſolithus.*

By the Romans called the *Neronien or Domitian Gem.*

In Perſia and India, called *Pacha.*

By the Arabians *Zamaruth,* vide Syſt. Nat. L. Edit. Gmel.

Its colour is pure green, which it loſes in fire, as alſo ſome of its weight.

It is found in hexagonal priſms, either perfect or truncated on the angles or edges, terminating in truncated pyramids.

The cryſtals are moſtly ſmooth on the ſurface, ſhining and tranſparent, in various degrees.

It is reckoned the ſofteſt of the gems, but ſeems to be harder than the rock cryſtal.

Its ſpec. gr. = 2,775.

It yielded by analyſis 24 parts of ſiliceous, 60 argillaceous, 8 of calcareous earth, and 6 of iron, from which it has the green colour.

The light green-coloured emerald is called the Oriental or Eaſt Indian kind, and is reckoned the beſt.

Its matrix is generally either quartz or calcareous ſpar.

The fineſt ſpecimen is ſaid to be in the treaſury of the Holy Chapel near Ancona.

Emeralds are brought to us from Ceylon, Pegu, Egypt, Braſil, and Peru.

Some are found in England, Italy, Germany, Hungary, Bretagne, &c.

The brown kind, Romé de Liſle has called the Peridot.

They are imitated by a mixture of one ounce of flint glaſs, and 5 grains of calx of copper.

SPEC.

Spec. VII.

GARNIT. German *granat*.

Cronstedt, *granatus martialis? & granatus crocis martis, & jovis mixtus.*

Waller. *granatus cryſtalliſatus pellucidis rubens nitens in igne colorem retinens, lapide liqueſcente.*

The garnits generally exhibit a red colour, or ſome of its ſhades; alſo greeniſh, white, and are of various degrees of tranſparency.

They are found in quartz, granit, gneiſs, micaceous ſhiſtus, ſerpentine, alſo in vitreous copper ore. They are ſeldom found of a black colour, as in the white feldſpar of Iceland.

It is ſaid the name garnit was given on account of their colour, which reſembles the flowers of the pomegranite tree.

Its ſpec. gr. = 4,100 to 4,412.

According to Romé de Liſle, its variety of ſhape ſeems to derive from a rhomboidal parallelopiped, terminating in 6 equal rhombs, the acute angles of which deſcribe 70°, and the obtuſe 110°, the parallelopiped compreſſed ſo as to exhibit two three-ſided obtuſe pyramids; the edges of one of the pyramids croſſing the faces of the

the opposite. The angle of the point of the pyramids is = 125°, which gives 55° for the angle of the base, corresponding on the two faces; from which it becomes clear, that when 4 of these primitive figures unite, they will exhibit a dodecagon, which may be considered as a six-sided rhomboidal prism, terminating in three-sided pyramids.

The following varieties with regard to its shape are frequently found.

1. Dodecagon with rhomboidal faces.

2. Exhibiting 24 faces, consisting of two eight-sided truncated pyramids.

* 3. Exhibiting 36 faces; the 12 large are rhomboidal, and the 24 smaller ones hexagonal.

4. Of 18 sides, consisting of a short six-sided prism terminating in two six-sided pyramids, &c. Vide *Romé de Lisle, and La Metherie.*

They do not lose their colour in fire, but become heavier, and are strongly attracted by the magnet.

They are found in various countries,—in the East-Indies, America, Ceylon, Cambaja, Syria, Armenia in Europe, Norway, Switzerland, Greenland, Siberia, Spain, Tyrol, Hungary, Bohemia, Saxony, &c. Those from Tyrol generally exhibit from 4 to 24 faces.

They were formerly much worn by ladies round the neck.

They

They are cut at Freyburg, and polished upon lead plates, with emery, tripoli, and spirit, or diluted acid, of vitriol.

They were used in medicine for various purposes.

The red garnits are moved by the magnet, and generally yield, by analysis, 48 parts of siliceous, 30 argillaceous, 11 calcareous earth, and 10 of iron.

The green kind contain, according to Wiegleb, more iron than the other kinds, but no argillaceous earth.

The common garnits in Saxony, &c. are, on account of their being so easily fusible, mixed with iron ores, to render them more fusible.

There is another variety of garnits, which are white, and always exhibit 24 trapezoidal faces. One sort is found in volcanic productions, lava, and tuffwakke, &c. which seems to have lost its colour by the subterraneous fire and sulphureous acid; but there is another kind, which seems not to have been thus altered, and which yields, on analysis, according to Bergman, 55 siliceous, 39 argillaceous, and 0,9 of calcareous earth, but no iron. This kind is not fusible by fire, like the red.

The red appearance of garnits may be imitated by a fusible mixture of 256 parts of flint glass, 128 gr. oxyd of antimony, 1 part oxyd of gold, and 1 of manganese.

SPEC. VIII.

CHRYSOLITH. So called in moſt languages. *Goldſtein* in German.

By CRONSTEDT, *Topazius cryſolithus.*

By WALLER. *gemma pellucidiſſima, duritie ſexta colore viride ſubflavo in igne fugaci.*

The Ancients gave this name to almoſt all ſtones of a yellowiſh green colour, without making any diſtinction with regard to figure or component parts; they took the topaz for cryſolith, and the cryſolith for topaz.

The name originates probably from the Greek χρυσο λιθος.

The cryſolith exhibits a yellowiſh green colour, ſometimes inclining to yellowiſh brown.

It is always found cryſtallized, and its regular ſhape exhibits a hexaedral flattened priſm, terminating in ſix-ſided pyramids, and therefore approaching to the figure of the rock cryſtal, but with this difference, that their pyramids are more flat or obtuſe. The angles of the points of the rock cryſtal deſcribe 40°, and thoſe of the cryſolith 50°. The angles formed by the pyramid and the face of the priſm are 130°, and by the rock cryſtal 142°. The priſm is ſometimes truncated, when it exhibits a dodecaedron.

x

dron. The cryſtals are longitudinally ſtriated on the broad ſide faces, and the reſt are ſmooth, tranſparent, and of a vitreous luſtre.

Romé de Liſle ſays, that thoſe which are brought from the Eaſt, exhibit a longiſh unequal-ſided priſm, terminating on both ends in a four-ſided cuneiform pyramid. They do not loſe their colour in fire.

Their ſpec. gr. = 3,098.

They yield on analyſis 15 parts of ſiliceous, 64 argillaceous, 17 calcareous earth, and 1 of iron.

They are found in the Eaſt Indies, at Braſil, Spain, Saxony, and Bohemia.

Some are found in lava in the Vavarre, ſometimes of 20 or 30 pounds weight.

The chryſoliths are ground with emery upon leaden plates, and poliſhed with tripoli and diluted ſulphuric acid, upon tin plates.

They are imitated by a fuſible mixture of 2 ounces of flint glaſs, 8 drams of red lead, and 12 grains of oxyd of iron.

SPEC. IX.

OLIVIN, SILEX OLIVINUS, alſo called *Volcanic Chryſolith.*

Its colour is olive green and aſparagus green: the latter kind is called *Augit*, and found cryſ-

tallized

tallized in 6, ſeldom in 4-ſided priſms, moſtly rectangular, with or without pyramids.

The cryſtals are longitudinally ſtriated; have a vitreous appearance; ſcratch rock cryſtals, but leſs hard than the cryſolith.

They yield on analyſis, according to Gmelin, $54\frac{1}{2}$ of ſiliceous, 40 of argillaceous earth, and 0, 3 of iron.

Are found imbodied in baſaltes.

Their colour can be extracted by nitric acid.

SPEC. X.

CROSS STONE or CROSS CRYSTAL.

Fr. *Pierre de Croix.* In Germ. *Kreuzkryſtal.*

By ROME' DE LISLE called *Shorles Cruciformes*, deſcribed in his 2d vol. of Cryſtalography, and delineated upon plate VII. fig. 38, 39, 40, 41, &c.

One kind is found at Andreaſberg on Harz, which by La Metherie is called Andreaſbergolite.

Its colour is greyiſh brown, ſometimes reddiſh brown, and ſeems to be compoſed of two flat 4-ſided

4-ſided priſms, cuniated and acuminated on both ends, interſecting each other at right angles. Romé de Liſle Cryſtal. plate IV. fig. 119.

The cryſtals ſtrike fire with ſteel, and ſome of them ſcratch glaſs; are ſoluble in nitric acid, and yield on analyſis, according to Weſtrumb, 44 ſiliceous, 20 argillaceous earth, 20 of ponderous ſpar, and 16 of water.

Another kind is called by La Metherie Staurolite, from the Greek name *Stouros* and *Litos.* Found in Bretagne in France, at Compoſtella in Gallicia, and deſcribed by *Robien.* Is found in blackiſh ſchiſtus: one he calls the true croſs-ſtone, compoſed of ſix-ſided priſms cutting each other generally at right angles.

The priſms are truncated, and without pyramids. Another variety exhibits a 4-ſided rhomboidal truncated priſm, the acute angles of which are = to 85°, and the obtuſe = 95. The priſm, when tranſverſely cut, exhibits a croſs, whoſe diviſions proceeding from the angles, are marked by a blackiſh ſubſtance; the interior ſubſtance appears of a yellowiſh grey colour.

SPEC-

SPEC. XI.

SHORL, SCOERL (*Cockle*, which ſeems to be an old Corniſh name). Lat. *Silex Scorlus*. This ſubſtance has been differently arranged; but I thought it would be beſt to place it among the ſiliceous ſtones, from its reſemblance to them in moſt of its properties.

Moſt varieties of it ſtrike fire with ſteel, and ſcratch glaſs; have a vitreous appearance, but melt eaſily into a ſpongy glaſs.

It is generally compoſed of vitrifiable and calcareous earth, and contains leſs iron than the garnits, and very ſeldom diſcovers a trace of magneſia. It is not acted upon by diluted nitric acid with effervеſcence.

It is found of various colours, red, black, greyiſh white, but generally green; is alſo tranſparent in different degrees.

The general ſhape which the ſhorl exhibits, is a ſix, or nine-ſided priſm, with three-ſided pyramids.

Romé de Liſle deſcribes its general figure as a much compreſſed rhomboidal parallelopiped, and conſiders it as a ſix ſided lenticular cryſtal, formed by two three-ſided pyramids joined by their

their bafes in fuch a manner, that the edges of one pyramid cut exactly the faces of the oppofite.

The rhombs of the parallelopiped have an acute angle = 66°, and an obtufe = 114°; they refemble in fhape the lenticular calcareous fpar.

Romé de Lifle and La Metherie divide the fhorls into two general claffes, the tranfparent and opaque. Moft of the tranfparent kind are electric when heated to about 200° Fahrenheit. Some fhew this property on being brought out of a cold into a warm room, but never when they have obtained the temperature of the room.

The fpec. gr. is generally = 3,000.

TRANSPARENT SHOERLS.

VAR. 1. PERIDOT, which was formerly placed under the gems, but was found by Romé de Lifle to be a fhorl.

Its colour is a yellowifh green.

Its general figure exhibits a ftriated fix-fided prifm, terminating in three-fided pyramids, with pentagonal faces. The prifm has fometimes 9 fides, which are varioufly fhaped.

Is found in Ceylon.

SPEC.

VAR. 2. TURMALIN, from Brafil. Syft. Nat. L. ed. Gmel. *Scorlus genuinus.*

WALLERIUS, Syft. Min. *Bafaltes figura columnare*, &c.

CRONSTEDT, Min. *Bafaltes chryftallifatus.*

Its colour is deep green.

It exhibits fix or nine-fided prifms, longitudinally ftreaked, and terminating in three-fided pyramids with pentagonal faces.

Its fpec. gr. = 31,500.

It does not ftrike fire with fteel.

The furface can be fcratched with a hard knife.

It melts *per fe* by means of the blow-pipe.

Is acted upon by nitric acid; is very little electric; a particular kind is attracted by the magnet.

Its matrix is generally granit, gneifs, &c.

VAR. 3. TURMALIN from Zeylon, *Afchendrower.* Syft. Nat. L. ed. Gm. *Schorlus electricus.*

WALLERIUS, *Zeolites facie vitrea*, &c.

This variety is moft electric, and is faid to be the firft in which this property was dif-

covered

covered by Lemery in 1717, by a piece of it having accidentally fallen into the aſhes of the furnace.

It was brought to Europe by the Dutch.

Its colour is generally deep red brown, ſeldom red or bluiſh.

Its ſpec. gr. = 30,541.

Its hardneſs is equal to the foregoing variety.

It exhibits ſix and nine-ſided priſms, terminating in two three-ſided pyramids with pentagonal faces.

The faces of the two pyramids proceed alternately from the faces of the priſm.

It melts difficultly.

It is electric, when heated to 200° Fahr. at this heat attracting light bodies by one end, and repelling them by the other.

If one end be heated, and the other cold, it attracts then on both ends.

It exhibits the electric power when expoſed to a ſudden change, by removal from a cold into a warm room.

It is not readily acted upon by ſulphuric, nitric, or muriatic acid.

It is laterally tranſparent, but not longitudinally, owing to the peculiar texture or poſition of the particles.

It yields by analyſis, according to Bergman, 37 parts of ſiliceous, 39 argillaceous, 15 of calcareous earth, and o, 9 of iron. Is found in the rivers at Zeylon, &c.

Var. 4. Turmalin, from Tyrol.

This kind was firſt diſcovered by Muller, in 1778; found in ſteatite rocks, on the high mountains in Tyrol. When held to the light it appears deep brown, but in thin lamellæ it appears deep green.

Its ſpec. gr. = 30,470.

Is a little harder than the foregoing kind.

It exhibits long three-ſided priſms, longitudinally ſtreaked; the priſms appear ſometimes ſix or nine-ſided by a ſimple or double truncation. The priſms terminate in three-ſided pyramids, which are ſeldom diſcovered, as the ends appear generally roundiſh.

This kind yields by analyſis, according to Bergman, 40 parts ſiliceous, 42 argillaceous, 12 calcareous earth, and o,6 of iron.

Var. 5. Turmalin, from Spain.

This kind was firſt diſcovered by Mr. Launoy, in 1782, in the mountains near Caſtille in Spain.

It reſembles much that from Tyrol, both in tranſparency, colour, hardneſs, and ſpecific gravity.

It

It melts, by long expofure to an intenfe heat, into a white vitreous mafs, owing to the fmall quantity of iron which it contains.

VAR. 6. GREEN SHORL, from Dauphiné; difcovered by Mr. De Bournon, in the mountains of Boury d'Oifon, in Dauphiné.

Its fpec. gr. = 34,529.

It fcratches glafs, and is found cryftallized in long ftriated prifms, with indeterminate faces.

Another kind is found in the Zitterthal in Tyrol, in reddifh fteatite, of equal degree of hardnefs with the turmalin, cryftallized in fix-fided prifms without pyramids.

Mr. Bergman found it containing 64 parts of filiceous, 0,3 argillaceous, 20 magnefia, 0,9 calcareous earth, and 0,4 of iron.

VAR. 7. RED SHORL.

Fr. *Shorl rouge.* Germ. *Rother Shorl.*

This kind has been found in fmall cryftals upon quartz, &c. In figure it refembles fhorl.

Romè de Lifle defcribes its cryftals as lenticular, compofed of two four-fided prifms without pyramids.

VAR. 8. WHITE SHORL.

Is found at Altenberg in Saxony, and alſo in Tyrol, and in the Pyrenees.

It is generally milk white, ſomewhat ſemi-tranſparent, and exhibits long ſtriated rhomboidal four-ſided priſms, which ſcratch glaſs, but are very brittle.

It ſeems to be compoſed of equal parts of quartz and argillaceous earth; I found the matrix of the ſame colour and nature, only the particles are not regularly ſhaped, and appear like a looſe white ſand-ſtone.

I have a ſpecimen of a micacious rock in my collection, containing two different ſubſtances, one of which exhibits properties and appearances of ſhorl.

One of theſe ſubſtances lays cloſe over the other, in the ſame direction; both are of the ſame magnitude and length. One is of a brown red colour, ſtrong—ſhining, ſmooth on the ſurface, ſemi-tranſparent, ſcratches glaſs, is not ſcratched by a hard knife, ſtrikes fire with ſteel, exhibits long four-ſided rhomboidal compact cryſtals, which are not acted upon by the nitric acid.

The other cryſtal is pearl white with blue ſhades, and ſeems rather to be compoſed of long rectangular plates, which are brittle, and break ſhort. The cryſtals are not acted upon by the nitric, muriatic acid. It ſeems to belong to the mica-

cious

cious kind. When expofed to the blow-pipe, it does not melt *per fe*, but lofes its colour.

I fhall fubmit both thefe fpecimens to an analyfis, in order to afcertain what genus of ftones they properly belong to.

The following varieties include, according to Romè de Lifle and La Metherie, the opaque fhorls.

Var. 9. Black Opaque Shorl. Is found in granit and gneifs, fometimes diffeminated through granit in very fmall particles.

It is alfo found cryftallized in long ftriated prifms of various fizes, fometimes an inch in diameter, and feveral inches long; fuch is found in Bretagne in granit. It is alfo frequently found in ferpentine.

1. The fhorl from Madagafcar exhibits a hexaedral prifm, terminating by two regular three-fided pyramids, proceeding from the alternate fide faces. The pyramids are fometimes truncated on the points, refembling the Turmalin from Zeylon.

It melts eafily *per fe*, and exhibits a greyifh white glafs. According to Wiegleb it contains 41 filiceous, 38 argillaceous, 17 of iron; but he found the proportions different in different fpecimens.

 2. The

2. The ſtriated opaque ſhorl exhibits long priſms with many ſtriæ running parallel on the axis of the priſm; it is difficult to aſcertain the number of ſides; ſix or nine ſides are generally diſcovered; its figure reſembles much the Turmalin from Spain and Tyrol.

Its ſpec. gr. = 30,926.

Var. 10. Red Opaque Shorl, found in mountains in Hungary.

It exhibits lenticular cryſtals with rhomboidal faces, the pyramids having three ſides, and one of the edges truncated, thereby exhibiting an hexagonal figure.

There is another variety of red ſhorl from Siberia, in white tranſparent quartz, exhibiting needle-ſhaped cryſtals, found near Catharinenburg, and called there ſpinel garnit, &c.

Its colour is blood red, crimſon, peach flower. Is generally found in fibres adhering to each other; it ſtrikes fire with ſteel, and ſcratches glaſs.

Its ſpec. gr. = 3,100.

It loſes its colour in fire.

According to Bindheim, it contains 57 gr. ſiliceous, 35 gr. argillaceous, half a gr. oxyd of iron and mangaueſe.

Var.

VAR. 11. VOLCANIC SHORL, found in volcanic products, as in the lava and pouzzolanes.

This ſhorl has a peculiar appearance; it is not proved yet, whether it has obtained its ſhape by fuſion, or exiſted in that ſtate before it came in contact with the fluid or melted lava, as we find ſome cryſtallized feldſpar in thoſe products. It cuts glaſs.

Its ſpec. gr. = 32,265.

Romè de Liſle derives its regular figure from a rhomboidal octagon, with truncated pyramids, which ſometimes reſemble a dodecagon.

That kind from Albano yields by analyſis, according to Bergman, 58 ſiliceous, 27 argillaceous, 0,4 calcareous, 0,11 magneſian earth, and 0,19 iron.

VAR. 12. FIBROUS OPAQUE SHORL.

This is compoſed of ſmall long priſmatic compreſſed cryſtals, like the fibrous zeolith, the fibres laying parallel. Some kinds reſemble the fibrous aſbeſtus. With this kind may be arranged the *ſtangen ſhorl*, ſo called by the Germans, which is compoſed of compreſſed long priſms, ſometimes parallel, ſometimes diverging. This kind is not ſo hard as the other ſhorls.

VAR. 13. LAMELLATED SHORL. *Hornblende, Shorlblende.* So called by La Metherie.

Its colour is generally black and deep green. It is found ſolid, interſperſed, and in priſmatic cryſtals.

Its ſpec. gr. = 29,000.

It is leſs hard than the real ſhorls.

It differs from the ſhorls in containing magneſia. According to Mr. Kirwan, it yields by analyſis 37 ſiliceous, 22 argillaceous, 0,2 calcareous, 16 magneſia, and 23 iron.

Another kind of gold colour is found in a green kind of ſerpentine, in a foreſt on Harzeburg.

SPEC. XII.

THUMERSTONE, PURPLE BROWN SHORL. Fr. *Shorl Violet*, from Thum in Saxony; alſo from Dauphiné, and in the Pyrenéan mountains.

It is called by La Metherie, *Yanolite*, Syſt. Nat. L. ed. Gm. *Shorlus vitreus*—was diſcovered by Mr. Desfontaine.

It has a perfect vitreous appearance, is in a more or leſs degree tranſparent; is generally found in flat rhomboidal cryſtals, with the two oppoſite edges a little truncated; the ſurfaces of the ſides are ſtreaked, and the ſurface of truncation perfectly ſmooth

ſmooth and ſtrong ſhining. It is ſo hard as to cut glaſs; ſtrikes fire with ſteel.

It yields by analyſis, according to Klaproth, 55 ſiliceous, 25 argillaceous, 0,9 calcareous earth, and 0,9 iron, 0,01, manganeſe.

Another ſimilar kind is found in lamellated embodied cryſtals, containing no manganeſe, leſs ſhining and leſs tranſparent than the before mentioned. This kind Mr. La Metherie mentions in his treatiſe to be the thumerſtone of Werner.

Spec. XIII.

QUARTZ in GENERAL.

QUARTZ. Lat. *Quarzum.*

This ſubſtance is ſo called in moſt languages. It is well known, and very common in Europe. It is diſtinguiſhed by the following properties.

1. It exhibits a vitreous appearance.

2. It is generally found full of cracks, which diſpoſe it to break into irregularly ſhaped pieces; when expoſed to a red heat it cracks ſtill more.

3. It does not melt *per ſe* when pure, nor does it loſe its weight or hardneſs in fire.

4. It is not affected by common air; is ſoluble in fluoric, but not in nitric or muriatic acid.

5. It ſtrikes fire with ſteel.

6. When melted with pot-ashes, in a due proportion, it gives a more solid and fixed glass than any of the foregoing siliceous stones; and when melted with three parts of pot-ash, it forms a glass, which attracts moisture from the atmosphere, and becomes gradually a transparent liquor, called *Liquor Silicus*.

It is found in solid masses exhibiting no particular shape. It is also interspersed through other stones, in the state of irregularly shaped pieces, of various sizes, as in granit, of which it forms an essential constituent part.

It is also found particularly shaped, and likewise crystallized, or of regular shape; is of different degrees of purity and transparency, and of a peculiar colour. It seldom forms large veins, and very rarely whole rocks in a separate state.

It is in general the purest of the siliceous stones, though not quite free from a slight mixture of other earths. The most obvious distinction among them arises from their different degrees of transparency, opacity, and colour.

It is a very useful mineral product for the glass manufactory, and particularly so when pure. When mixed with pot-ash and oxyd of lead, it makes flint glass; and when very pure, as in the crystallized state, it serves for optical purposes.

For

For both purpoſes, Switzerland, particularly the mountain St. Godhard, affords the greateſt quantities: pieces are there found from 5 to 800 pounds weight.

At Madagaſcar cryſtals were found of ſix feet long and four wide, and at Fiſhbach in the Valais, a piece was found of 1200 pounds weight.

Different States of Quartz.

QUARTZ in general may be divided,

1. Into ſuch as is found cryſtallized, tranſparent, and very pure, either colourleſs or a little coloured, called Rock Cryſtals.

2. Into ſuch as is leſs pure, leſs tranſparent, found either in maſſes or cryſtallized, colourleſs or coloured, called Pure Quartz.

3. Exhibiting a peculiar colour, called Amethyſt.

VAR. 1. ROCK-CRYSTAL; by the Germans *Bergkryſtal.*

French, *Cryſtal de Roche.*

LINN. *Cryſtallus Montana.*

WALLER. *Cryſtallus Montana hexagona.*

CRONSTEDT, *Quarzum Cryſtalliſatum.*

This is the pureſt kind of all quartz. It contains the ſmalleſt portion of other ſubſtances, and does not loſe its tranſparency in fire like other quartz.

When

When of regular figure it exhibits a dodecagon or fix-fided prifms, terminating in fix-fided pyramids, the faces of which proceed from the fides of the prifms. The prifms are tranfverfely ftriated, but the faces of acumination are fmooth.

It is feldom found in maffes, but often exhibits various modifications of its primitive figure; is partly colourlefs, fometimes exhibiting various colours, fometimes coated with pyrites, quartz, fand, &c.

Its fpec. gr. is generally = 2,653.

Varieties of Cryftallization.

Rock-cryftal is found, 1. in long and fhort prifms, with pyramids either on one, or on both ends.

2. In pyramids without prifms.

The pyramids are either fimple or double.

The faces of acumination are either regular, or they exhibit various forms; and the faces of acumination proceed fometimes from the fide edges.

Colour, arifing from metallic fubftances.

a. Bright amber yellow,
b. Chocolate brown,
c. Greyifh and yellowifh white, } from Bohemia.

d. Brown, from Siberia.

e. Perfectly colourlefs, from Prieborn, Silefia, &c.

Figure

Figure in particular.

(A.) Prismatic.

a. In prisms with pyramids on one end, from Vogtland, Ehrenfriederſdorf, Switzerland, Bohemia, Freiberg, Schneeberg, canton Bern. Of this kind are found alſo two cryſtals, joined by their ſide faces in various directions, ſometimes the baſis of one is placed on the ſide of the other.

b. In priſms terminating on both ends in pyramids, from Vogtland, &c.

c. In ſhort priſms, with pyramids on both ends, from Marmoroſa and Upper Hungary.

(B.) Pyramidical.

In ſmall double pyramids, ſeldom three-ſided, with an alternation of ſmall and large faces exhibiting pentagons, ſuch as are found at Prieborn, Sileſia, &c.

a. In ſix-ſided pyramids, with double acumination—from Sileſia.

b. In ſix-ſided pyramids, with unequal faces—from Sileſia, &c.

c. The ſame, but terminating in ſmall two and three-ſided pyramids.

d. The ſame, with the edges a little truncated.

e. In

e. In ſix-ſided pyramids, terminating in three-ſided pyramids, proceeding from the alternate ſide faces or edges.

Cryſtals of a Second Formation.

Original cryſtals coated over with additional quartz, or other ſubſtances, as the pyramidical quartz, coated with a cornelian coloured ſubſtance, from Ehrenfriederſdorf, &c.

Cryſtals containing heterogeneous Subſtances included.

Arſenical pyrites, and calcareous ſpar, from Ehrenfriederſdorf.

White amianth.

Mica, from the ſame place.

Fluor and ſteatite.

Chlorit and needle-ſhaped mangaueſe.

Green ſhorl, heavy ſpar, ſpecular iron-ſtone, martial æthiops, copper pyrites—moſt of them found in Dauphiny.

VAR. 2. PURE QUARTZ. Lat. *Quarzum purum.*

(A) This kind of quartz is not ſo pure as the foregoing, is leſs tranſparent, and more brittle, and becomes perfectly opaque in fire. It is found in the ſtate of *ſolid maſſes*, or pieces, with a gloſſy ſurface, exhibiting no particular ſhape.

Semi-tranſparent, and colourleſs.

In this ſtate it is found in copper mines, in the north part of Norway and Siberia.

Semi-

Semi-tranſparent at Ehrenfriederſdorf, and in a leſs degree in Bohemia.

Variety of TEXTURE.

a. Granular. 1. White—in the gold mines at Adelsfors, in the province of Sudermania, &c.

2. Pale green—in the ſame place.

b. Sparry. Very ſcarce.

1. Whitiſh yellow—in the gold mines in Hungary.

2. White—in the iſland of Utto.

c. Lamellated. White, yellow and blue—in the gold mines in Hungary.

d. In Grains. As fine white ſand—from Schneeberg.

Var. of COLOUR.

a. White. — From Freiberg, Gerſdorf, &c.

Greyiſh white, from Freiberg, &c.

b. Grey. Deep ſmoak grey, at Schneeberg.

Alſo bluiſh grey, pearl grey, near Freiberg and Schneeberg.

c. Yellow. Honey-coloured—from the Harz.

d. Red. 1. Blood red—from Spain.

2. Fleſh-colour—from Schneeberg.

3. Crimſon—from Saxony.

4. Violet—from the iſland of Utto.

5. Amethyſt with white quartz—from Heidelberg.

e. Blue. From the iſland of Utto, in the province of Smoland.

f. Green. 1. Olivegreen—from Johanngeorgenſtadt.

2. Pale green—from Adelfors.

(B.) Particular Shapes.

a. Nodular. Yellowiſh white—from a ſand mine near Leipſic.

b. Stalactitical—from Breibach on the Hackſberg, in the biſhopric of Cologne, from Iceland, and Uſbanga in Hungary.

c. Reniform—from Iſaac near Frieberg.

d. Cellular—from Pereſowſkoy near Catharinenburg in Siberia, and at Schneeberg.

e. Cylindrical—from Hungary near Schemnitz, and at Freiberg.

(C.) Of regular Shape, or Crystallized Quartz.

Lat. *Quarzum cryſtalliſatum.*

In this ſtate it is found of various degrees of tranſparency, till to opaque.

As to Figure.

a. Priſmatic, with pyramids generally ſix-ſided, with regular and irregular ſhaped faces.

b. In *pyramids* without priſms.

The

The pyramidical cryſtals are found ſimple and double, and alſo in the ſtate of groups ordruſic, ſeldom in ſingle cryſtals.

The cryſtals are alſo found of various colours.

a. Pearl grey, in Hungary.

b. Smoak grey, } at Schneeberg, and near
c. Honey yellow, } Briſtol.

d. Reddiſh, at Gerſdorf, Weſtmania, Bohemia and Sileſia, and Oran in the Barbary.

e. Deep greeniſh grey, near Freiberg.

f. Black, in the Palatinate.

g. Deep blood red, at Schneeberg.

h. Crimſon, in Saxony.

i. Green, in Dauphiny and Saxony.

k. Blue, called *falſe ſaphir*, in Bohemia, Sileſia, and France.

l. Roſe colour, in Hungary and Bohemia.

(C.) Of Seldom Figures.

a. Cubical figure, ſometimes with pyramids, at *Schneeberg*.

b. Rhomboidal figure, with the edges truncated, in the valley *Bijoux*, near *Ghent*.

c. In rhomboidal four-ſided plates, partly acuminated, ſometimes with impreſſions, near Freiberg.

Var.

Var. 3. Amethyst, or amethyst-coloured quartz.

Lat. *Amethyſtus.*

This kind, belonging to the ſiliceous ſtones, exhibits a peculiar colour, is found in ſolid maſſes of various texture, as conchoidal, fibrous, ſhelly, granulated, &c. and of various degrees of tranſparency; has various ſhades of colour, and is found cryſtallized.

Is found particularly fine in Mexico, Sweden, Bohemia, and Saxony.

The amethyſt from Saxony has yielded by analyſis 30 parts of ſiliceous, 60 argillaceous, 8,22 calcareous earth, and 1,66 iron.

(A.) In masses, partly solid, partly in layers.

a. Tranſparent, inclining to opaque, from Deuxpont; generally found with common quartz or calcedony.

b. Shades of colour.

1. Whitiſh, from Wieſenbach.
2. Greeniſh white, from Saxony.

Places where particular kinds are found.

a. Fibrous, at Wieſenbad.

b. Conchoidal, at the ſame place.

c. Granulated,

c. Granulated, bar-ſhaped, near Freiberg, in the Palatinate, Deuxpont and Schneeberg.

In grains at Heidelberg.

(B.) THAT OF REGULAR SHAPE, OR CRYSTALLIZED, IS FOUND,

a. In ſimple perfect ſix-ſided pyramidical cryſtals, at Deuxpont.

b. With faces of different ſizes, at Drehbach near Ehrenfriederſdorf.

The cryſtals are ſometimes found adhering to each other.

The amethyſt is found in decompoſed gneiſs, calcedony, flint, &c.

VAR. 4. PRASE.

Praſe ſeems to have its name from the Greek word πρασον, which ſignifies blueiſh green.

VALERIUS, *Achates pellucida nebuloſa viridescens.*

CRONSTEDT, *Smaragd matt.*

This ſtone may alſo be conſidered as a variety of the coloured quartz. It is diſtinguiſhed by its colour, which is either deep leek green, ſeldom graſs green, or olive green; when broken it is ſhining, and of a ſhivery texture, generally ſemi-tranſparent, and hard; it is found in ſimple ſix-ſided pyramids, ſeldom in ſix-ſided priſms, acu-

H minated

minated by ſix faces; very ſcarce, in ſmall ſix-ſided plates; it contains ſiliceous, argillaceous, magneſian earth, and iron.

It is found near Koſemitz inSileſia, in Dauphiné, in Bohemia near Breitenbrunnen, in Saxony near Chamouni, and in the environs of Schwarzberg, in large layers containing ores. The layers are compoſed of magnetic iron pyrites, galena, blend, quartz, and common green radiated ſhorl. It ſeems to have its colour of the latter, with which it is found mixed. This ſubſtance has by ſome authors been conſidered as a variety of the cryſopraſe.

Spec. XIV.

FLINT. *Silex pyromachus.*

French. *Pierre à feu.* Germ. *Feuerſtein* (ſo called becauſe it is generally uſed for ſtriking light). Ital. *Pietra focaya.*

It is found in maſſes of various ſizes, chiefly and almoſt only in Flötz mountains, which are either of a peculiar nature, or in ſuch ſtrata as are compoſed of chalk or lime-ſtone—leſs frequently in primitive mountains—on flat land it was once found cryſtallized, by Mr. Voyt of Weimar, in a place near *Johanngeorgenſtadt.*

It contains frequently petrifactions, particularly of the *cruſtaceous,* and the ſmall *coraline,* genus;

it

it is alſo found bearing impreſſions of *echenits* and *belemnits*, &c.

It is generally found of a yellowiſh ſmoke grey; or black grey colour, ſeldom of other colours.

a. Pale yellowiſh white—from *Upper Luſatia.*

b. Amber colour—from *Lithuania.*

c. Reddiſh grey with white ſpots—from *Johanngeorgenſtadt.*

d. Deep oker yellow, with circles of a black kind—in *England.*

e. Greyiſh black in pudding ſtones—in *England*, and deep black on the *Engliſh coaſts.*

f. Yellowiſh and greeniſh grey ſpotted—alſo in *England.*

It is found ſolid, interſperſed, in angular pieces; in grains, in nodules and globular perforated lumps, almond-ſhaped, ſeldom needle-ſhaped; alſo in pebbles, very ſeldom cryſtallized, in flat double three-ſided pyramids, the ſides of one proceeding from the edges of the other.

Its ſurface is generally little ſhining; when broken it exhibits a conchoidal ſurface, and the fragments are ſharp edged, but of an indeterminate ſhape; ſemi-tranſparent in different degrees; harder than the common quartz; and cannot be ſcraped with a hard knife.

Its ſpec. gr. = 2,594.

It ſtrikes fire with ſteel.

When expoſed to a ſtrong heat, it cracks, loſes its colour, and becomes more opaque. Its colour probably arifes from ferruginous earth, or other fubftances containing oxyd of metals. It decays not fo eafily in air as the jafper, but fooner than quartz, and when decayed it exhibits a chalky appearance; by expofing it to a ftrong heat, it melts at laft into a blackifh vitreous fubftance; it makes glafs when melted with pot-afh, but feems not to be fo good for that purpofe as the quartz.

It takes a high polifh, and is therefore ufed for making buttons, fmall boxes, mounting canes, fticks, &c. In England it is alfo ufed for certain mixtures of glafs and earthen ware. When reduced to a fine powder, it is excellent for glafs-grinding.

It is more tranfparent than the jafper. It often fhows evident marks of having been originally in a foft flimy and tough ftate, like glue.

According to Wiegeleb fome kinds yield by analyfis 80 filiceous, 18 argillaceous, 2 calcareous earth.

To the flint belong alfo thofe mixed ftones called pudding-ftones, which are frequently found in England: they confift generally of roundifh varioufly coloured flint pebbles, from the fize of a hazel-nut down to the fize of hemp-feed, which are conglomerated by a mixture of quartz, hornftone, or jafper; thefe ftones take alfo a high polifh, and exhibit often a beautiful appearance, and are therefore ufed for boxes, &c.

With

With regard to the formation and compoſition of flint, mineralogiſts have ſuggeſted various opinions. Mr. *Werner* ſays, it conſiſts particularly of ſiliceous earth, cryſtallizing water, a ſmall quantity of calcareous earth, and inflammable matter. Others believe it to be compoſed of ſiliceous, argillaceous, and occaſionally a little calcareous earth.

Flint is found in the ſea, as well as on land, containing various ſhells, corals, and ſea worms, attached to the ſurface, but more frequent in Flötz mountains, in chalk and limeſtone; ſometimes in coal ſtrata, as near *Wettin*; in alum rocks, near *Freienwalde:* when found perforated, it has been noted to ariſe from a decompoſition of corals, and other parts of ſea animals.

Peirecius has obſerved, as *Valerius* mentions, that the pebbles and flint have been formed in ſea water, from a mixed maſs of a ſlimy conſiſtence, which had become hard by the excluſion of the water. It has alſo been obſerved, that flint had its origin from the calcareous ſubſtance, of which the ſhells and corals moſtly conſiſt, and the gelatinous and other parts of animals in a ſtate not quite deſtroyed; but nothing has yet been decided on this ſubject.

Spec. XV.

CHERT. *Petro Silex.*

Lat. *Lapis corneus.*

Ital.

Ital. *Pietra cornia.*
French. *Pierre de corne.*
Swed. *Haella flinta.*
Germ. *Hornſtein* (reſembling horn).

La Metherie has arranged it with the ſhörls and hornblende.

The chert is generally found in maſſes, perhaps never cryſtallized, except in Saxony, in the mine called Wolfgangermaaſſen; it is generally found inclining to opaque, or in a leſs degree ſemi-tranſparent than the flint, but more tranſparent than the jaſper, which is hardly ever found ſemi-tranſparent in any degree. When broken, it diſcovers a ſhivery and conchoidal texture, and has then the appearance of a piece of wax, the colour excepted; it exhibits a coarſer texture than the flint.

Its ſpec. gr. = 2,708.

It is a little acted upon by acids.

By breathing on it, it diſcovers an earthy ſmell; ſtrikes now and then fire with ſteel; can be eaſily ſcratched with a hard knife; does not take a high poliſh like flint; it decompoſes ſooner than flint, when expoſed to air; it melts by itſelf without ebullition; it melts with ſoda with effervеſcence, but is not quite ſoluble in it; it alſo melts with borax and microcoſmic ſalts.

It yields by analyſis 72 ſiliceous, 24 argillaceous, and 6 of calcareous earth.

As

As to Colour, it is found,

Yellowiſh white—from *Johanngeorgenſtadt.*

Blueiſh—from *Schneeberg.*

Pearl green, inclining to red—from *Saalberg* in *Switzerland*, and alſo in *Saxony*, &c.

Reddiſh grey—from *Orenburg.*

Reddiſh brown—from *Schneeberg.*

Carnation and roſe colour—from the ſame place.

Pale green—from *Orenburg, Gerſebach* near *Meiſſen*, and near *Freiberg*; alſo from *Preſtgrufvan* and *Hellefors* in *Weſtmanland.*

Deep mountain green—from *Tyrol, Garpenberg* in *Switzerland.*

Smoke grey—near *Freiberg*, &c.

Blackiſh grey—from *Lorenzgegentrun*, near *Freiberg.*

Deep blackiſh brown—from *Schneeberg.*

It is found in the Ganges of primitive mountains, alſo in Flötz mountains. It forms veins and beds of mountains, but never whole mountains. It is alſo frequently found in nodules like kernels in rocks; whereas the jaſper conſtitutes often the chief ſubſtance of the higheſt and moſt extended chain of mountains.

The chert is likewiſe found in great quantity in the neighbourhood of ſcaly lime-ſtone, like flint, in ſtrata of chalk; whereas the flint and agates are generally found in looſe and ſingle irregular nodules.

As to its uſe, it is employed in the manufactory of common glaſs and ſtone ware.

Spec. XVI.

CALCEDONY, WHITE AGATH. *Calcedonius.*

Wallerius, *Agates, &c.*

Calcedony, ſo called from Calcedon, the name of a place.

This ſubſtance is generally found in ſolid maſſes of a globular, kidney-like, or ſtalactitical figure; or in the ſtate of pebbles.

Thoſe which are reniform are often found hollow, containing petrified wood, corals, ſhells, &c.

It is hardly ever found in layers. When broken it exhibits a conchoidal ſurface, is ſemi-tranſparent, ſtrikes fire with ſteel, and takes a very high poliſh.

Its ſpec. gr. is generally = 2,615.

It is not readily acted upon by acids; when expoſed to heat it does not melt *per ſe*, but loſes its colour, and becomes more opaque.

Its general colour is greyiſh, yellowiſh, white, or milk-white, but it is ſeldom found of any other colour.

The calcedony from the Eaſt and Ceylon is reckoned the beſt. It is frequently found in Italy,

Italy, Hungary, Saxony, Silesia, Feroe Islands. Seals and particular vases are made out of it.

By analysis it yields a great portion of siliceous earth, a little calcareous, less argillaceous earth, and a small portion of iron.

The calcedony from the Feroe Islands has yielded by analysis 84 siliceous, and 16 of argillaceous earth.

VAR. I. CALCEDONY. *Calcedonius genuinus.* WALLERIUS, *Agathes Vix pellucida nebulosa colore griseo mixta.*

This kind is found of various shapes, viz. kidney-shaped, stalactitical, globular, botrioid; also assume the appearance of hollow pebbles, sometimes containing air-bubbles, or drops of water; the latter kind is called in French *Hydrocalcedoine*, and is found on a hill near Vicenza, on the way leading to Madona di Monte Berico. The matrix consists of black volcanic ashes.

Those pebbles, containing drops of water, have been found from the size of a pea to half an inch in diameter.

It is supposed they have been formed from ashes by heat, and that the water had accidentally entered the mass, before it acquired its hardness; they are very scarce.

In the same way zeolites have been found in the mass of calcedony in the Feroe Islands.

Calcedony

Calcedony is alſo found in the ſhape of almonds, mixed in trap.

Other ſpecimens exhibit dentritical vegetations, probably originating from a ſolution of iron, or ſome other ſubſtance, pervading a maſs of calcedony. This kind is called *Mocha-ſtone*, or dentritical agate.

It is brought to Europe from the port of Mocha. Sometimes the calcedony is found coating other ſubſtances.

The pure calcedony is found milk white, inclining to blueiſh, ſmoke grey, pearl grey, yellowiſh grey, fleſh colour, amber colour, mountain green, graſs green, olive green, generally in the Feroe Iſlands; milk-white with red ſpots, in *Oberſtein*; black in Saxony and *Chemnitz*; brown near the river *Tom* in Siberia; yellow in the ſame place, and in Ceylon, Hungary, Saxony, &c.

VAR. 2. CACHOLONY, *Calcedonius cacholonius.* WALLERIUS, *Agathes opalina tenax, fractura inequali.*

This variety has probably its name from the Kalmucki language; it is ſaid that *Cholony* ſignifies in that language a ſtone, and *Cach* a ſtream, near the Kalmucks of Buchareſt, in which it was firſt found.

Mr.

Mr. Pallas derives the word Cacholony from the Mongool language, and ſays that the beſt kind is found in the deſert of Gobo.

It is of a milk-white colour, more opaque than the common calcedony. It is worked by the Kalmucks, who make idols and domeſtic veſſels of it: it is very hard, and takes a fine poliſh.

It is alſo found in the Feroe Iſles, where it lies between the ſtrata of ſemi-tranſparent calcedony. It is never found in drops or ſtalactitical, and ſeems to be a coarſer variety of the true calcedony.

Var. 3. Carnelian.

Sarda by the Ancients.

Wallerius, *Carneolus.*

Gmelin, *Calcedonius carneolus.*

The name of this ſtone, report ſays, was originally derived from its reſemblance to fleſh.

It is generally found exhibiting various ſhades of the blood colour, ſeldom an equal colour. It loſes its colour in the fire. It is ſeldom found ſemi-tranſparent, generally inclining to opaque; poſſeſſes the ſame hardneſs as the calcedony; when broken it exhibits a conchoidal fracture.

Its ſpec. gr. is generally = 2,630 or 2,700.

It ſeems to be a kind of calcedony of a reddiſh colour, but of a finer texture than the calcedony; never contains petrefactions.

It

It is found in ſolid pieces, like pebbles, ſeldom kidney-ſhaped; ſometimes in thin layers; the beſt kind has a deep red colour reſembling the garnits; is found in Arabia.

Carnelian is alſo found near Chemnitz, Zwickau, and Freiberg; and of an inferior quality in Sileſia and Bohemia. It is found oftener in the Eaſt, viz Ceylon, Armenia, Paleſtina, Egypt, alſo in Siberia.

It is found of various colours;—as, 1. reddiſh, white, or fleſh colour.

2. Yellowiſh white.

3. Browniſh red.

4. Scarlet.

It is ſaid that the ancients improved the beauty of theſe ſtones by boiling them in honey. When the carnelian is mixed with onyx it is called ſard-onyx; or white agate ſard-agate.

Spec. XVII.

ONYX.

Cronstedt. *Onyx Camehuja Memphites.*

Gmel. *Chalcedonius Onyx.*

Wallerius, *Achates vix Semipellucida faſciis ſtratis diverſe coloratis ornata.*

In Ital. *Nicolo.*

The ancients called all calcedonics onyxes.

The

The word Onyx is probably derived from the Greek language, and ſignifies the nail of the finger, which theſe ſtones reſemble as to their colour.

They were called Memphites from a town called Memphis in Egypt, whence they were brought to us.

By the modern writers the onyx is called Carneus camahuja; in Ital. camei.

The old Romans were accuſtomed to cut figures on the ſtrait-lined onyxes in *alto*, or *baſſo relievo*, which they called Camehuja; they are counterfeited, and called *camei*.

The onyx conſiſts of different-coloured veins, which run parallel to each other, ſometimes in ſtraight, ſometimes in curved, lines.

Thoſe which conſiſt of concentric circles were alſo called Mephites.

Another kind, poliſhed and cut, is ſet in rings, and called *Occhi di Gatti*, which, in hardneſs, luſtre, and property, equals the calcedony.

The onyx loſes its colour in the fire, and cracks and breaks, if the heat be ſudden or violent.

Its ſpec. gr. is from 2,500 to 2,600.

It is found in irregular ſhaped pieces, in neſts, in layers, and aſſumes frequently a pebble-like appearance. When the onyx is mixed with other ſtones, ſuch as jaſper, it is called jaſp-onyx; and in in like manner, when mixed with carnelian or ſardoine, is called ſard-onyx; when mixed with calcedony, calced-onyx; with agate, agate-onyx.

It is ſaid that this ſtone is highly eſteemed in the eaſtern countries; and that in China, where it is called *Yow*, nobody but the Emperor has permiſſion to wear it.

As the onyx is found in large pieces, the ancients were accuſtomed to make out of it various veſſels, and figures repreſenting faces, upon which is diſplayed the natural colour of the veins and hair. And their art, known to modern artiſts, conſiſted in the juxtapoſition of particularly coloured pieces of onyx, achat, jaſper, and calcedony, diſpoſed in ſuch a manner as to produce a perfect likeneſs of faces and figures; and this deception cannot be diſcovered, except by putting them into hot water, which diſſolves or ſoftens the maſtic with which they are cemented.

Spec. XVIII.

The Sardoine, ſo called by the French, is a ſemi-tranſparent agath or calcedony of an orange colour, variegated like calcedony; of the ſame hardneſs and gravity.

When expoſed to fire, it is found to poſſeſs the ſame properties as the agate.

Its

Its colours appear more lively when tranſverſely looked at.

Daubenton diſtinguiſhes five varieties:

1. The pale one.

2. Exhibiting red and white veins, ſo diſpoſed as to appear like teeth.

3. Sard-onyx, which ſeems to be compoſed of concentric layers of different colours, with concentric circles.

4. Exhibiting vegetations.

5. Blackiſh.

Sardonyx. This ſtone has been variouſly deſcribed.

By ſome it has been conſidered as a mixture of calcedony and carnelian; by others, as a mixture of carnelian and onyx; and others hold it to be the tranſparent orange-coloured agate with variegated ſurface, reſembling the calcedony.

The variouſly-coloured component parts generally exhibit parallel ſtripes.

It is ſometimes confuſedly blended or mixed.

Its ſpecific gravity is generally = 2,630 or 2,700.

It loſes its colour in fire.

It generally ſtrikes fire with ſteel.

The ſtriped kind with red zones may, as well as the onyx, be cut into cameo.

The

The ſardonyx is found exhibiting dentritical figures, reſembling the calcedony or agate, and is alſo called *Mocha-ſtone*; but it differs from the real *Mocha-ſtone* in this, that the ſtripes are red, whilſt thoſe in the calcedony are black.

The onyx and ſardonyx are imitated by vitreous fluxes, but they are ſoon diſcovered by the file and the vitreous appearance.

It ſeems that the ancients knew how to imitate them, as ſuch ſtones are found among the paſtes of the ancients, which reſemble the onyx very much. Steatites or ſpeck-ſtone is the beſt ſubſtance for this purpoſe, as it is ſoft, and becomes very hard when expoſed to heat, ſo as to ſtrike fire with ſteel, and takes a high poliſh.

The onyx of a blackiſh appearance is imitated as Van Boot points out. He directs to take a certain quantity of pulverized ſea-ſhells, ſuch as the Italian ladies uſe for paint, and to mix it with filtered lemon-juice, in ſuch quantity as to aſcend four fingers high above the powder. This mixture is for ten days to be expoſed to a gentle heat in a cloſe glaſs veſſel; afterward the liquid is decanted, and the powder well waſhed, and rubbed with the white of an egg. After which it is eaſily moulded into various figures.

SPEC.

SPEC. XIX.

CHRYSOPRASE.

GMEL. *Chalcedonius Chryſopraſus*

Germ. *Gold—Praſer.*

This ſtone is beſt ranked amongſt the ſiliceous ſtones; and may with propriety be placed next to calcedony, which it reſembles moſt.

It exhibits generally an apple-green, graſs-green, or greeniſh white colour. It is found in ſolid maſſes, and breaks with an even ſurface, having a dull appearance. Its fragments have an indeterminate angular figure, moſtly ſharp-edged. It is generally ſemi-tranſparent, but more frequently inclining to opaque; is hard, but does not ſtrike fire with ſteel. It has its colour from oxyd of nickel, and yields on analyſis 69,16 ſiliceous, 0,08 argillaceous, 0,82 calcareous earth, 0,08 iron, and 1 nickel.

The fineſt kind is found near Koſemütz, in the principality of Münſterberg, in Lower Sileſia. It is generally found looſe, in pebbles, on the Altenberg, near Hachlau; in the environs of Olp, near Turnau; and in the Mummel Grund, on the banks of the Iſer, in Bohemia, near Munſterberg. It is found with opal horn-ſtone, in layers of aſbeſt, talc, lithomarge, and iron ochre.

Spec. XX.

AVANTURIN.

This ſtone is alſo with much propriety ranked among the ſiliceous mixed ſtones. It is ſaid to owe its name to the reſemblance it bears to a glaſs flux, called by the Italians avanturino, which was firſt prepared at Moreno, near Venice, and, as report ſays, accidentally diſcovered, while experiments were making on glaſs fluxes, by a ſmall portion of gold falling into a mixture of this kind, which on cooling exhibited ſo beautiful a colour, that after further experiments by which it was improved, it was eſteemed of ſufficient value to be ſet in rings, and faſhioned into ſmall boxes.

The true, or at leaſt that kind of ſtone which was called the natural avanturine, ſeldom exhibits ſo fine an appearance as the artificial, and is beſides ſcarce. A very fine large ſpecimen may be ſeen in the Leverian Muſeum, which was found in the ruins of the triumphal arch of Julius Cæſar, in the valley of Suſe in Piedmont, in 1783, by the Sieur Francis Ludwig, of Mayence, in Germany.

The ſtones called avanturines, are compoſed of different ſubſtances, but are generally ſiliceous, when they ſtrike fire with ſteel. They take a fine poliſh, and are not readily acted upon by any acid, except the fluoric. A few varieties contain calcareous

calcareous earth, and thoſe effervefce weakly with acids.

Some have ranked the avanturines among the opals. Romè de Liſle, who gives the beſt account of the avanturine, ſays it is produced by an intimate mixture or aggregation of quartzoſe grains, differently coloured, and diſpoſed in ſuch a manner as by the reflection of the light to exhibit an appearance as if gold duſt were mixed with it.

But ſtones are found, called avanturines, which certainly contain gold-like pyrites, micaceous iron-ſtone, and common pyrites. Some of theſe reſemble quartz, ſome feldſpar, others jaſper, &c. They are found of various colours:

1. Of a deep colour, ſemi-tranſparent, exhibiting ſhining lamellæ of a gold colour, and in the form of roundiſh pebbles, at *Arragonia* in Spain, where this kind is called the red avanturine.

2. Found with ſhining lamellæ of a ſilver-white colour, called the grey avanturine.

3. Of a yellow colour.

4. Of a blackiſh colour, ſemi-tranſparent, the lamellæ of a ſilver-white colour, called the black, or Oriental avanturine.

5. The ſame kind, but the lamellæ exhibit a golden colour, at *Facebaj*, in Tranſylvania.

6. Compoſed of deep grey quartz, containing iron pyrites, in a ſtellated poſition, in Saxony.

7. Brown and yellowiſh-red coloured ſiliceous particles, mixed with clay, containing a little gold and ſilver, like pyrites, in Spain.

8. Rhomboidal feldſpar, of a brown and roſe colour, found in granit.

9. Siliceous pebble, in iron-ſtone reſembling marſhy iron ore, in Bretagne.

10. Yellowiſh quartz with gold-coloured mica interſperſed.

11. White ſhining marble containing mica.

12. Rhomboidal calcareous ſpar, containing pyrites. They are imitated by immerſing red-hot quartz in cold water, when the cracks exhibit an appearance reſembling the avanturine.

Spec. XXI.

HELIOTROP. *Blood-Stone. Silex Heliotropius.* Gmel. *Chalcedonius Heliotropius.*
Wallerius, *Jaſpis variegata obſcure viridis, punctis rubris.*

This ſtone is generally of a leek-green colour, with blood red ſpots or veins. It is ſaid to be ſo called becauſe when it is put into water it reflects the rays of the ſun red, and when out of water it was ſaid to exhibit the figure of the ſun and moon.

Certain

Certain authors have deſcribed it as a green jaſper with red ſpots; but Mr. Werner conſiders it as a peculiar ſpecies, becauſe it is ſemi-tranſparent, and exhibits a conchoidal ſurface when broken.

Its ſpec. gr. = 2,633.

It is found particularly fine in the Eaſt and Egypt.

La Metherie arranges it with the agates.

AGATE, or ACHATES.

This ſubſtance cannot properly be conſidered as a peculiar ſpecies, as it is merely an imperfect mixture of different ſtones. It is ſaid that it has its name from the river *Achates*, in Sicily, where it was found by the ancients.

As to its general appearance, it approaches neareſt to the calcedony; is generally ſemi-tranſparent, and is never found cryſtalliſed, owing perhaps to the admixture of argillaceous earth; but it ſometimes contains the rock-cryſtals in a cryſtalliſed ſtate.

It is generally compoſed of ſeveral of the following ſubſtances, as quartz, rock-cryſtal, hornſtone, flint, amethyſt, jaſper, indurated lithomarge, and heliotrop.

Calcedony ſeems to be its principal baſis. From the various ſubſtances of which it is compoſed,

poſed, ariſe its various colours, and alſo its different degrees of tranſparency or opacity.

On account of the different diſpoſition of the component parts and figures which it exhibits, it has obtained different names, ſo is its tranſparent part owing to the rock cryſtals or quartz; the milk-white colour from calcedony; the ſmoke grey from flint; the yellowiſh grey from yellow flint and jaſper; the blood red from red jaſper; purple from amethyſt; and the green from heliotrop.

The agate is generally found in the ſtate of neſts, pebbles kidney-ſhaped, hardly ever in layers; never forming whole rocks, as the jaſper. It contains a greater portion of ſiliceous earth than the jaſper; is generally ſo hard as to ſtrike fire with ſteel.

From ſome obſervations it has appeared, that the mixture of the agate maſs has been in a liquid ſtate, and has ſo entered the cavities of certain ſtones, as the apertures are generally found very obvious, and that when the liquid maſs has been a mixture of different ſubſtances, the agate formed from it of courſe exhibits various colours; and when the different component parts have entered ſeparately or ſucceſſively into the cavities, the agate exhibits then zones of different colour and appearance, and more or leſs tranſparent or opaque. When the component

component parts run parallel through its matrix, the agate is then called ribband-agate. When the component parts have formed arborifations, it has been called *arborifed agate* or *mocca ftone.*

The agates are alfo by fome authors denominated according to their predominating component parts; fo it is called, 1ftly. *calcedonous agate*, when the calcedony predominates; or 2dly, *fardon-agate*, if the cornelian predominates; 3dly. *jafper-agate*, when the jafper prevails; and 4thly. *amethyft-agate*, when the amethyft prevails.

Some mineralogifts arrange the Egyptian pebbles with the agate.

A femi-tranfparent kind with red fpots is called *gemma divi ftephani.* Some kinds difplay the colours of the rainbow.

The following varieties are generally noticed.

1. Fortification agate.
2. Landfcape agate.
3. Mofs agate.
4. Agate fpotted, refembling ftars.
5. Ribbon agate.
6. Tubulous agate.
7. Variegated-agate, exhibiting circular zones.

In commerce, thofe which are the moft perfect are called Oriental agates, and the others Occidental.

Germany produces undoubtedly the greateſt quantity, and alſo the beſt kind of agates; they are found particularly in the Lower Palatinate, near Alzey, Flonheim, Uſhoven, and Oberſtein; in Deuxponts, near Utzenbach, Grühnbach, &c.; in Saxony, at Kunnerſdorf, Schlottwitz, Verzenſtein; at Hallſbach, near Freiberg; at Rothlof, near Chemnitz; at Wiederau, near Rochlitz, in Bohemia and Sileſia.

SPEC. XXII.

JASPER, JASPIS.

WALLER. *Petro ſilex jaſpideus.*

Ital. *Diaſpro,*

The jaſper is a ſtone approaching more to the nature of ſiliceous than to that of the argillaceous ſtones, amongſt which it has been ranked by Mr. Werner.

It is found in veins and beds in mountains, forming the matrix of porphyr; ſometimes it forms whole parts of rocks.

It is the only kind of ſtones that is found of all varieties of colour, and is found almoſt in all countries.

It

It has an appearance as if it originated from indurated bole, flint, and calcareous earth, combined with an unknown menſtruum.

It is never found cryſtallized; it breaks into pieces of indeterminate ſhape, takes a good poliſh, and is more eaſily affected by air than quartz.

Its red colour becomes deeper in the fire, but it does not melt *per ſe*.

Its ſurface ſometimes denotes the ſilex, and, when freſh broken, it is conchoidal, reſembling much an indurated clay; certain kinds have an earthy dull appearance, and a fine texture. The jaſper is not ſo hard as quartz; ſome kind ſtrike fire with ſteel.

As it is not readily acted upon by acids, heat and long digeſtion with the vitriolic acid, are required, in order to extract the argillaceous earth and iron, with which it forms alum and martial vitriol.

By the application of heat it is not rendered quite ſoluble in ſoda, but it effervefces, and divides into fine particles.

It melts with borax and microcoſmic ſalt, without effervefcence; it does not become electric, nor does it crackle in the fire or loſe its colour.

Its ſpec. gr. is = 2,600, or 2,700.

It is compoſed of ſiliceous argillaceous earth, and a conſiderable portion of iron.

The

The jaſpers are generally arranged or divided according to the different colour they exhibit.

Mr. Daubenton has mentioned the following 15 varieties, viz.

1. The *green* kind, from Bohemia, Sileſia, Siberia, and the ſhores of the Caſpian Sea.

2. The *red*, or the *diaſpro roſſo* of the Italians, which is not ſo common, nor in ſuch great maſſes as the green.

3. The *yellow*, from Freiberg and Rochlitz. It is ſometimes of a citron colour, looks as if compoſed of ſilky filaments, and is called the ſilk jaſper.

4. *Brown*, from Dalecarlia, in Sweden; alſo from Finland.

5. The *violet*, from Siberia.

6. The *black*, from Sweden, Saxony, and Finland. This is the *paragone antico* of the Italians.

7. The *blueiſh grey*, which is very rare.

8. *The milky white*, of which Pliny ſpeaks. It is found in Dalecarlia.

9. The *variegated*, with green, red, and yellow clouds.

10. The *blood-ſtone*, which is green, with red ſpecks, from Egypt, and was ſuppoſed to ſtop bleedings.

11. The *veined*, with various colours, which, when it reſembles letters, is called *jaſpe grammatique*

matique by the French. Some of this kind are found near Rochelle, in France, and called *polygrammatogues* by thofe who prize trifling accidental qualities.

12. That which has various coloured zones.

13. That called *fionto* by the Italians, which difplays various colours, without any regular order.

14. When the jafper has a great number of colours together, it is then called *univerfal.*

15. When the jafper is found to contain agate, it is called *agatifed jafper.*

Cronftedt divides the jafper into

1. The pure jafper of various colour.

2. Jafper containing iron, *jafpis martialis finople.* This kind contains 18 or 20 per cent. of iron.

(A) Coarfe grained.

A red and reddifh brown finople, from the Hungarian gold mines, near Chimnitz; it forms confiderable veins. It has frequently fpecks of marcafite; contains cubic lead ore and blend, and the gold it contains more than compenfates the labour of working it; there is likewife a ftriped finople of various colours.

(B) Steel grained or fine grained.

A reddifh brown, from Altenberg, in Saxony, looks like the red ochre or chalk ufed for drawing, and has partitions for veins, which are unctuous to the touch like ferpentine.

(C) Of

(C) Of a cloſe and ſhining texture like a flag.

a. Liver coloured.

b. Deep red, in the province of Wermeland, and at Sponwyit, in Norway.

c. Yellow, from Bohemia.

Werner arranges the jaſper with the argillaceous ſtones; he mentions particularly four kinds.

VAR. I. EGYPTIAN PEBBLE.

French. *Caillou d'Egypte.*

Germ. *Egyptenſtein.*

GMEL. *Jaſpis Ægyptia.*

This ſtone differs a little from the real jaſper, and would be better ſeparated from the other real jaſpers.

It has the appearance of being formed by coagulation.

It is found in oval longiſh flattened pebbles, outwardly of a liver brown colour, toward the interior part inclining to yellowiſh cream colour and yellowiſh grey, moſtly with concentrical ſtripes or dentritical figures, called by the French *Caillou herboriſé.*

Its ſpec. gr. = 2,564.

When broken, it exhibits a glittering moſtly. dull conchoidal ſurface; its fragments are irregularly angular, opaque, and hard, and take a fine poliſh.

It is made into variouſly ſhaped veſſels.

It

It is found on the ſhores of the Nile, near Cairo, in Upper Egypt; alſo in Arabia, at Freiſen, in Lothringen.

VAR. 2. RIBBAND JASPER.
GMEL. *Jaſpis faſciata.*
WALLER. *Jaſpis variegata faſciata.*

This kind exhibits always different colours, moſtly in ſtraight parallel, but ſeldom in curved lines or layers.

The moſt general colours are,

The yellowiſh grey, browniſh red, ſeldom mountain green, red, and lavender blue.

It is found ſolid in long layers; when broken it exhibits a dull ſomewhat conchoidal ſurface, is ſometimes ſemi-tranſparent on the edge, and takes a high poliſh.

It is found in Siberia, in Saxony, near Gnadſtin and Wolftitz, but particularly fine at Ural.

VAR. 3. PORCELANE JASPER.
GMEL. *Jaſpis porcelanea.*

This kind is of a pearl grey or lavender blue colour. It is found in compact layers, frequently between the fiſſures of baſaltes. It is diſtinguiſhed by its arid appearance, and by its cracks or ſlits. Its ſurface, when newly broken, is a little ſhining and

and gibbous. The fragments are of an irregular ſhape, ſharp edged, not brittle but hard.

It is very frequently found in Bohemian mountains, near Strake, Schwintſchiz, Leſſa, &c.

Var. 4. Common Jasper.

Gmel. *Jaſpis vulgaris.*

Cronstedt. *Jaſpis.*

Waller. *Jaſpis particulis ſubtiliſſimis unicoloris, &c.*

This kind is found of a yellowiſh white, blueiſh grey, or ochre yellow colour. It is moſt generally of a yellowiſh and liver-brown blood and cochineal red colour, though ſometimes it exhibits many colours.

It is found compact, ſometimes coarſely interſperſed with other ſtones in alternate layers, and is often ſeen in obtuſe angular pieces. When broken it exhibits a faintly ſhining ſurface, more or leſs gibbous and opaque.

It is found in various places in Germany; in Saxony, between Altenberg and Geiſing, near Freiberg, Johanngeorgenſtadt; in Sileſia, near Turnau; Schemnitz, in Hungary, &c. alſo in the Eaſtern countries.

Sometimes jaſper contains petrified wood (called wood-ſtone by Werner) exhibiting various colours. The apple green is found particularly fine near Coburg.

The

The black jaſper is alſo particularly fine, and to this probably belongs the baſaltes of the ancients, or lapis Æthiopicus.

The ſinople is a brown red ferruginous jaſper, called by Born, ferrum jaſpideum.

There is another kind, which is compoſed of cinnabar and quartz, found at Mörsfeld in the Palatinate, and Tuſcany.

The green jaſper with red ſpeck is found at Kuttenberg in Bohemia.

Some kinds of jaſper contain animal petrifactions, viz.

1. The red and brown jaſper with trochits, found near Potſdam.

2. The ſinople, containing madrepors, near Schemnitz.

Spec. XXIII.

SILICEOUS SHISTUS.

Germ. *Gemeiner Kieſelſchiefer.*

French, *Petroſilex ſchiſteux.*

Gmel. *Lydius ſiliceus.*

This ſtone is of a ſmoke deep blackiſh green, and blackiſh colour, often containing veins of grey quartz or blood-red iron-ſtone. When broken its ſurface has a dull appearance; has a ſhivery texture. It breaks in indeterminate ſhaped pieces,

pieces, ſemi-tranſparent on the edges, is ſo hard as to take a good poliſh. It yields by analyſis 75 ſiliceous, 4,58 magneſia, 10 calcareous earth, and 3,54 iron.

Is found generally in mountains of argillaceous ſhiſtus.

With this may be ranked the Leidiſher Stein of Werner, or touchſtone; French, *pierre de touche*, lapis Lidicus.

That ſtone which Mr. Werner has pointed out is of a deep greyiſh black colour. When broken it has a faintly glittering appearance, a conchoid ſurface, perfectly opaque.

It yielded by analyſis, according to Mr. Wiegleb, 75 parts of ſiliceous, 4,58 magneſian, 10 calcareous earth, and 3,54 iron.

It is generally found with ſiliceous ſhiſtus.

Almoſt all ſtones which are not of a calcareous nature will ſerve for the ſame purpoſe, viz. jaſper, petroſilex, argillaceous ſhiſtus, baſaltes, trapp, &c. &c.

SPEC. XXIV.

OBSIDIAN, ICELAND AGATE.

GMEL. *Lava vitrea.*

WALLER. *Porus igneus lapideus ſolidus vitreus. Lapis obſideanus.*

This ſtone is of a greyiſh, moſtly a blackiſh colour. It is found in irregularly ſhaped pieces.

Its external ſurface is aſh grey and opaque; when broken, it ſhews a convex, ſhining ſurface.

Its fragments are ſharp edged. It is ſemi-tranſparent on the edges, and rather light, hard, and electric.

It is found in Iceland, and near Tokay in Upper Hungary, forming the baſis of a certain kind of porphyr.

Mr. Werner was the firſt who ſhewed that this ſtone was a peculiar ſpecies of ſtones. Before him it was denominated lava-glaſs, or agate; in ſhort it was conſidered to be merely a volcanic production. Mr. Werner has alſo proved that this mineral is not reſtricted to Heckla in Iceland, but is alſo found incorporated with other ſtones in other parts. Pieces of it are found in Tokay and Madagaſcar.

Mr. Gerhard found it alſo in decompoſed granit, gneiſs, porphyr, &c. in the ſtate of ſeparate pieces, which Mr. Gerhard calls lux-ſaphyr. From this it is evident that the name lava-glaſs is improper, and the denomination agate not leſs ſo. Beſides, it has been proved that this mineral anſwers to the deſcription of the ſubſtance which Pliny calls Obſidian.

SPEC. XXV.

VARIOLIT.

This ſtone is not much known, and is found only in few parts of Europe.

It is found in roundish masses, in the Durance near Briançon.

Is generally of a blackish green colour, opaque, has a dull appearance when broken; is hard, and takes a greasy polish. It contains small pale mountain green globules intermixed, which give the surface of the stone an appearance somewhat similar to the appearance of many pustules in the small-pox, whence it has the name Variolit. It is composed of siliceous, argillaceous, calcareous earth, and iron.

SPEC. XXVI.

FELDSPAR.

Germ. *Feldspath.* Latin *Feldspathum.*

CRONSTEDT. *Spathum Scintillans, rhombic quartz.*

This stone is composed of shining lamellæ, placed one over the other, often in an irregular manner, but its figure approaches always either to the cubical or rhomboidal.

It breaks also in pieces, which exhibit that figure. It is of a lamellated texture, is softer than the quartz, but it strikes generally fire with steel: it is generally opaque, but also found semi-transparent. Its surface can be scratched with a hard knife. It is decomposed, when long exposed to air and moisture, into white clay or lithomarge. It does not crackle when exposed

to

to a ſudden heat; does not become phoſphoreſcent. It melts by a ſtrong heat, without ebullition, and when melted with alcali, it forms a tranſparent greeniſh glaſs. It does not efferveſce with acids, and the acids act upon it only when digeſted with them for ſome time, and that heat is applied.

Its ſpec. gr. is generally = 2,500.

It is chiefly compoſed of ſiliceous earth, intimately mixed with argillaceous and magneſian earths, and fluoric acids.

The feldſpar is one of the principal component parts of the primitive ſtones or rocks, ſuch as the granit, porphyr, ſerpentine, &c. It is found in ſolid maſſes of a particular ſhape, as in garnits; or in the ſtrata of decompoſition, as in ſand from decompoſed granit; and often found cryſtallized, and of various colours. Its primitive figure is that of a rhomb, with one angle of 65°, and the other of 115°.

The rhomb exhibits often a four-ſided rectangular priſm, obliquely truncated on its extremities, with an angle of 60° and 120°. The priſm is ſometimes found truncated on the angles, which makes it appear a ſuboctaedron, and the pyramid has various faces; ſometimes the priſm becomes an hexaedron. Its figure undergoes various other modifications.

It has its name from the German language. *Feld* ſignifies a field, and alſo a compartment or regular ſurface. Thus feldſpar is compoſed of little compartments of rhomboic or other figures, and *ſpath* is an old miner's word, and is underſtood to be a ſemi-tranſparent ſtone, of a rhomboidal figure, compoſed of certain angles, indicating the texture.

It is found of various colours, white, reddiſh, greeniſh, yellowiſh, and blueiſh.

Mr. Werner mentions four varieties.

VAR. I. COMMON FIELDSPAR.

Germ. *Gemeiner Feldſpath.*

Latin. *Feldſpatum Vulgare.*

This kind is generally found of a pale colour, as fleſh colour, yellowiſh, grey, whiteiſh, milk white, but ſeldom of a vivid green, or blueiſh colour.

It is found compact, ſolid, and incorporated with other ſubſtances. Its regular ſhape is that of a four or ſix-ſided rhomboidal priſm, with different accuminations, or that of a parallelopiped, but ſeldom aſſumes the form of a rectangular priſm, having four, ſix, and eight ſides; very ſeldom in cubes, in fine ſemi-tranſparent needle-ſhaped cryſtals, or in ſix-ſided plates.

When broken, the ſurface is a little ſhining, has a lamellated texture, the fragments are rhomboidal.

boidal. Is leſs hard than quartz, but ſtrikes fire with ſteel. Its ſpec. gr. = 2,594, and yields generally by analyſis 74 parts ſiliceous, and 24 argillaceous earth. Is frequently found in the mixture of the two primitive mountains, as the granit and gneiſs, alſo in ſmall particles in porphyr. A red kind yielded by analyſis 79 ſiliceous, 16 argillaceous earth, and 2,3 of iron. In the Portſoy-granit at Aberdeenſhire, it conſtitutes the chief component part, in which the fieldſpar is divided by quartz, in certain directions, and the mica ſcarcely diſcovered.

VAR. 2. COMPACT FIELDSPAR.

WERNER, *Argilla Feldſpatum ſolidum.*

Its colour is generally grey green, alſo blueiſh. It is found ſolid and interſperſed, has a lamellated texture, breaks in indeterminate acute angular pieces, and is almoſt ſemi-tranſparent. It is found, though rarely, in a mixture of quartz and mica in *Steiermark.* Mr. Maggellan has added another variety, which he calls the white fieldſpar, deſcribed by Mr. Bayen, which is found at St. Marie, in the mines in Lorraine. He ſays it ſtrikes fire with ſteel, but is more readily acted upon by acids than the other kinds, and is compoſed of half its weight of ſiliceous, and the other half of magneſia and iron. Another kind from Alençon contains, beſides ſilex and magneſia,

 ſome

ſome calçareous earth, and a greater proportion of iron.

Var. 3. Labrador-Stone.

Gmel. *Feldſpatum Variabile.*

Cronstedt. Edit. Magell. *Spatum rutilum verſicolor.*

This kind of fieldſpar is generally of a light or deep grey colour, but when held in certain directions to the light, it reflects various colours, as lazuli-blue, graſs-green, apple-green, pea-green, ſeldom a lemon-yellow. Some have an intermediate colour betwixt red copper and tompac grey, and beſides other colours between grey and violet. Theſe colours are ſeen for the moſt part in ſpots, but ſometimes in ſtripes on the ſame piece. It is found of angular form in pretty large pieces, containing occaſionally black bar-ſhorl, mica, and iron pyrites interſperſed. When broken, its ſurface is ſhining, its texture foliated, and the fragments are rhomboidal. They are ſemi-tranſparent, and in other reſpects agree with the fieldſpar. It is only 15 or 16 years ſince this beautiful ſtone was made known to us. According to Dr. *Brückmann* of Brunſwick, it was firſt diſcovered by Mr. Wolf, on the Labrador Coaſt, in North America, where the Moravians have a colony among the Eſkimaux. Mr. Wolf diſcovered this ſtone accidentally, on the ſea ſhore under the water, by the variety of colours which it reflected under the water, from the action of the rays of the sun on it.

Mr. Wolf gave it to Bishop Leiriz, who first brought it to Europe.

It is found on the island St. Paul's in the greatest quantity. The Labrador stone is found in layers, and often deposited by the sea on the Labrador Coast.

It contains not unfrequently quartz and micaceous particles, which induced Dr. Brückmann to believe that it entered into the composition of certain kinds of granit.

Mr. Pallas mentions that near Petersbourg has been found Labrador-stone, containing metallic veins.

Mr. Gerhard has also found some, near Potsdam. It has been found, though very seldom, near Lobau in Upper Lusatia, in Bohemia near Iser, on Ural in Siberia. Mr. Lucar in Halle discovered a Labrador-stone in the street, among plaster-stones on the pavement, which was taken up and examined in the year 1790, and was found to be chiefly granit. Its weight was near 600 pounds; when polished it reflected the light with different colours, which characterises the Labradors. The quartz which it contained was smoke-grey, and the mica partly blackish brown, partly yellowish white. On some places the fieldſpar ſeemed to predominate, which is of a greyiſh white colour, with blue ſhades, has a lamellated texture, and the fragments are rhomboidal.

VAR. 4. MOONSTONE.

GMEL. *Feldſpatum lunare.*

Argilla feldſpatum lunare, by WERNER.

French. *Pierre de Lune.*

Germ. *Mondſtein.*

This ſtone is generally greyiſh white, milk white, ſeldom of a pale fleſh colour, having a luſtre ſimilar to mother-of-pearls, and is ſemi-tranſparent. It is found in obtuſe angular pieces, ſometimes approaching to cubical, and has a lamellated texture. The fragments are rhomboidal, and in other reſpects it reſembles the common fieldſpar. It is found in Ceylon.

With this ſpecies may be ranked the ADULARIA, which is generally of a white colour, ſometimes a little inclining to greeniſh or yellowiſh white, of a lamellated texture. The lamellæ of the ſurface are often ſo diſpoſed as to reflect the light in various colours. Its luſtre reſembles often that of mother-of-pearls. It is harder than the common fieldſpar, and generally ſemi-tranſparent. It is found in ſolid pieces, and alſo cryſtallized, of rhomboidal figure, and of irregular, angular, broad ſix-ſided columns,

columns, terminating in pyramids, and in rectangular four-ſided plates.

It yielded by analyſis 62,43 parts of ſiliceous, 19,33 of argillaceous, 5,5 magneſia, 10,98 ſelenite, and 1,75 water.

It is found on St. Gothard, in Switzerland, in Delphinate, Ceylon, and near Leipzig at Altranſtaedt.

VAR. 5. CATS EYE.

WALLERIUS. *Achates plus minus, opaca, colores vel lucem diverſimode reflectens.*

GMEL. *Feldſpatum, Oculus Cati.*

CRONSTEDT. *Pſeudo palus.*

Germ. *Ratzen Auge.*

French. *Oeil de Chat.*

The *Sun Stone of the Turks.*

This ſtone has alſo been differently arranged; ſome have placed it with the opals.

It has its name from its reſemblance to cats eyes. Its colour is generally yellowiſh or greeniſh, and a glow of light iſſues from certain points of its ſurface, in radiations of a yellowiſh brown colour, ſomewhat ſimilar to cats eyes. Its texture is ſo compact, that the lamellæ are hardly diſcernable. It is ſo hard as to ſtrike fire with ſteel; is ſemi-tranſparent.

It is found in Ceylon and Siberia.

Its ſpec. gr. = 2,657.

Dr.

Dr. Brückmann has a ſpecimen of it half an inch in diameter in all directions; and the grand duke of Tuſcany has one an inch in diameter.

THE GIRASOL.

This ſtone is by ſome mineralogiſts conſidered as a kind of cats eye, of a ſea colour, reflecting a blue light. This is perhaps what certain mineralogiſts call the fiſh-eye ſtone. The Giraſol is generally deſcribed to be a milk-blueiſh ſemi-tranſparent ſtone, which reflects various colours. Its diſtinguiſhing character is, its exhibiting a globular or ſemi-globular pebble, having luminous points, which reflect the light in all directions. It is found in Chypre, Calatie, Hungary, Bohemia, and in the mines of Bretagne. The Giraſol is often ranked among the opals, which it reſembles much. Profeſſor Blumenbach mentions in his book another variety of fieldſpar, which he calls Edelſpath, *feldſpatum gemmeum*. This ſtone differs from the other fieldſpar in this, that it is of a higher colour, more tranſparent, reſembling certain gems, is harder, and has a finer texture. It reſembles the ſaphyr-ſpar or ſtar-ſaphyr from Ceylon, and the emerald ſpar from Orenburg.

SPEC.

Spec. XXVII.

OPAL, OPALUS.

Paedros of the Greeks.

Girasol of the Italian.

Also called *Lapis Elementarius,* from its exhibiting various colours.

The opal has been often ranked among the gems, and by others among the argillaceous stones, though they exhibit more marks of the softer kind of the siliceous stones. It is a hard semi-transparent stone, which reflects the light in various colours, according to the direction in which it is held to the light. Dr. Brückmann, who has given an excellent account of the opals in his book on gems, supposes that the reflection of the various colours arises from the disposition of its texture or cracks, which the best opals always discover. *Delius* attributes the various colours to iron and inflammable substances.

It is generally found of a milk white, blueish white, and greenish colour, seldom reflecting the purple and green colour, and those are of very high value. The opal takes a fine polish, but is not so hard as to strike fire with steel.

It is not fusible *per se,* but becomes quite opaque, and loses its colour in the fire.

Its spec. gr. is = 1,900, sometimes a little more.

It is not readily acted upon by acids, but some kinds of opals were boiled in sulphuric and vi-

triolic

triolic acid, and produced alum, which accounts for the aluminous earth which it contains, which had not intimately enough combined with the silex, as is observable in the other gems of the siliceous genus.

It has never been found crystallized.

Most of the opals are somewhat hydrophanous, and have small cavities in their texture. The opals appear more beautiful when immersed in water.

When just separated from the matrix, they have generally the appearance of ice, but after they have been exposed to air or heat, they become more opaque, and exhibit also various colours.

According to some analysis, the opals are composed for the most part of siliceous earth, and a little argillaceous earth; some in the following proportion, 86 siliceous, and 14 of argillaceous earth.

Dr. Beireis thinks the opals are volcanic product, or their component parts are combined by means of the subterraneous fire. Its matrix is generally clay, sand, and ferruginous earth.

It is found in different parts of the world, particularly fine in Hungary. The opals were much esteemed by the ancients, and are now so by the Turks, and in the East Indies.

Mr. Werner mentions four varieties.

VAR. 1. OPALUS NOBILIS.

The real Opal, or *Opal of many Colours.*

Germ. *Edler Opal.*

WALLERIUS. *Opalus colore olivari, reflexione ruber.*

This kind is generally milkiſh white, inclining to blueiſh; when held to the light appears yellowiſh or reddiſh; ſome reflect various other colours, as green, yellow, red, and blueiſh.

Its ſpec. gr. is = 2,114, ſometimes leſs.

It is found in ſolid pieces, ſometimes it is found incorporated in other ſtones. When broken, its ſurface appears conchoidal, and has a ſtrong luſtre. The fragments are ſemi-tranſparent, and not very hard.

It is found in the Carpathian mountains, and at Eperies near Ezernizka in Upper Hungary.

VAR. 2. COMMON OPAL, *Opalus Vulgaris.*

WALLERIUS. *Achates fere pellucida colores pro ſitu ſpectatoris mutans?*

This kind differs from the foregoing, in not reflecting the light with ſo beautiful colours.

Its general colour is milk white, ſeldom with ſhades of green or fleſh colour.

It is found near Radamiſchel in Poland, near Koſemütz in Sileſia; near Johanngeorgenſtadt, Eibenſtock, where it is occaſionally found in granit; in Saxony near Freiberg and Frankfurt.

5 According

According to Mr. Klaproth, it yields by analysis 98 siliceous, 0,1 argillaceous earth, and 0,1 iron.

Var. 3. Oculus Mundi, *Hydrophan. Lapis mutabilis.*

Germ. *Weltauge.*

Gmel. *Opalus Hydrophanus.*

Wallerius. *Achates unguinum colore, in aere opaca, aqua pellucida.*

This stone was formerly of great value, but little known to moderns, before Mr. Boyle did notice it particularly.

It is distinguished from the real opals and other stones in this peculiar property, that it becomes transparent when put into water, and loses its colour or opacity, which it recovers when dry. During the absorption of water it emits a musty smell and air bubbles, so that it becomes evident that this property of becoming transparent in water arises from its porous texture, by means of which it absorbs the water, and dislodges the air contained in the pores. It also absorbs melted wax, and becomes then of course transparent when heated, and is then called *Pyrophan.*

It adheres to the tongue, and is of less specific gravity than the real opal.

It is generally easily acted upon by acids; is not very hard, so that it can be easily cut and polished.

Some

Some kinds, befides being tranfparent, exhibit various colours, like certain kinds of real opal, as the colour of mother-of-pearls, or other colours; but then they are fcarce, and of high value.

The hydrophan becomes alfo tranfparent when immerfed in vitriolic acid, but it retains its tranfparency until the acid is taken away by an alcali.

It is generally found to accompany other ftones, or in the ftate of incruftation in contact with opal, calcedony, prafem, chryfoprafe, granit, jafper, or indurated clay. Seldom (if at all) exhibiting three-fided pyramids, fuch is faid to have been found on the Ferroe Iflands. The hydrophans are generally found near Ezerizka and Lipftop in Hungary, in Silefia near Eibenftock, Schneeberg.

They yield by analyfis filiceous, argillaceous earth, and a little iron; fome have been found to contain alfo magnefian earth.

Much pains have been taken in order to difcover its nature and formation, but nothing particular has been afcertained refpecting it.

Brückmann and Veltheim have given the beft accounts of it.

Some mineralogifts believe it to originate from the opal having undergone a certain decompofition or change; others confider them as opals that have not attained a perfect ftate.

VAR.

Var. 4. Halb Opal, by Werner.
Gmel. *Opalus vilior.*

This kind is found of various colours, blueiſh, pearl, reddiſh, greeniſh, yellowiſh grey, wax and honey colour, fleſh and hyacinth red, &c. Sometimes one ſpecimen reflects two colours, ſuch as red and blueiſh grey.

It is found ſolid, very ſeldom incorporated in other ſtones; when freſh broken, it exhibits in a greater or leſs degree a ſhining ſurface; ſometimes it has a waxy, ſometimes a vitreous luſtre. The texture is conchoidal, the fragments are ſharp edges, are more or leſs ſemi-tranſparent on the edges, brittle, and not very hard.

It is found in Hungary, in Iceland near Coſemütz, in Sileſia, in Bohemia near Freiberg, at Johanngeorgenſtadt, &c.

Karſten (*Muſeum Leſkianum*) mentions three inſtances of the change of this opal into ſubſtances of a different appearance, namely, the halb opal changing into hornſtone, porcelain earth, and into jaſper. By the firſt proceſs it loſes its hardneſs and luſtre. Its texture appears ſhivery; and by the ſecond change it loſes all tranſparency, hardneſs, and gradually takes an earthy appearance, and adheres to the tongue.

Var.

VAR. 5. WOOD OPAL.

Germ. *Holz Opal.*

GMEL. *Opalus Ligneus.*

This kind, refembling petrified wood, is of a milk, reddifh and yellowifh white, hair and chocolate brown, or hyacinth colour; generally one fpecimen exhibits various colours.

It is found in folid maffes, fometimes mixed with wax opal, has a fhining furface, generally femi-tranfparent on the edges. Its texture is rather fhivery or fibrous, fometimes conchoidal, but always conchoid when tranfverfely broken.

It is found in Hungary near Chemnitz.

SPEC. XXVIII.

PITCH-STONE.

Germ. *Pechftein.*

French. *Pierre de poix.*

GMEL. *Opalus piceus.*

This ftone, which was firft mentioned by Schulze, has its name from the German word *pech*, which fignifies pitch, Lat. *pix*, to which it has great refemblance.

Its nature is not yet well afcertained.

Romè de Lifle ranks this ftone amongft the volcanic products; and Mr. Kirwan particularly among the lava, becaufe it was often found in volcanic countries; but this is no proof, as it is alfo

 found

found in the Pyrenees, where no traces of volcanoes have been discovered.

The pitch-stone is found at Mesnil Montant, near Paris, in beds; frequently in Bohemia, Silesia, Hungary, Siebenbürgen, Frankfurth on the Mayn.

In Saxony the pitch-stone forms whole masses, and makes the basis of certain kinds of porphyr.

It is else found in layers of a globular or stalactitical form, and is sometimes crystallized.

The common kind is of a brown colour, melts *per se* in strong fire, but with much difficulty. That from Saxony seems rather to be a peculiar kind. It melts easily into a flaggy mass.

Sometimes the pitch-stone is found semitransparent, but more generally opaque, of an imperfect conchoidal texture.

Its spec. gr. = 2,300.

Its various colours are white, yellow, colophony brown, greenish, seldom transparent. It is so hard as to scratch glass. Some mineralogists suppose it to be composed of quartz, feldspar, porphyr, jasper, and iron.

It yields by analysis 64,58 siliceous, 15,41 argillaceous, and 5 of iron.

SPEC. XXIX.

PREHNIT.

GMEL. *Zeolitus viridis.*
French. *Zeolithe verdatre.*

This ftone is called after Captain Prehn, who brought it firft to Europe in the year 1783, from the Cape; and Mr. Werner, who faw it firft at Drefden, gave it this name.

This ftone bears fome refemblance to zeolith, on which account it has been confidered as a variety of the zeoliths. It is found in folid maffes, fometimes cryftallized. It has only been found of an apple green, or greenifh grey colour.

Its fpec. gr. = 2,942. When broken, its furface is a little fhining, and has a lamellated, fometimes a fibrous texture. It melts by the blow-pipe, but with a ftronger ebullition than the zeolith, but does not exhibit a gelatinous appearance, when diffolved in acids.

It is fometimes fo hard as to ftrike fire with fteel. It is generally femi-tranfparent and brittle.

By analyfis it has yielded 43,83 filiceous, 30,33, argillaceous, 18,33 calcareous earth, 5,66 iron, 1,83 water.

It is found at the Cape, and in Dauphiné. Its primitive figure feems to be the rhomboidal four-fided plate, but it exhibits generally various modifications of its primitive figure.

Of the cryſtallized kind there are known,

1. The perfect four-ſided rhomboidal plates.
2. The ſame, but truncated.
   a. On all the end edges, or
   b. Merely on the ſharp end edges.
3. The irregular ſix-ſided plates.
4. In broad four-ſided columns, a little cuniated on the ends from the narrow ſide faces; the edges are a little truncated; the cryſtals are always ſmall, very ſeldom ſeparated, generally accumulated, and adhere by their ſide faces.

The ſurface of the cryſtals, found in a divided ſtate from each other, is ſmooth. Thoſe cryſtals, however, which are found adhering to each other in various directions, have a ſtriated ſurface.

Spec. XXX.

ZEOLITE, ZEOLITHUS.

This ſtone has probably its name from the Greek words *Zeos* and *Litos*. It was firſt deſcribed by Cronſtedt in the year 1756. Certain kinds of it bear ſome reſemblance to ſhörl, though they differ from it in various properties.

The colour of the zeolithus is generally opaque, ſeldom ſemi-tranſparent; it is hard, but ſeldom ſo hard as to ſtrike fire with ſteel.

Its ſpec. gr. = 2,500, ſometimes more.

It is ſoluble without effervеſcence, in acids, which reduce it to a gelatinous maſs. When expoſed expofed to a very ftrong heat, it melts *per fe* into a white opaque flag. In melting, it emits a phofphorefcent light, and like borax melts with ebullition. It diffolves more eafily with foda than with borax or microcofmic falt, but does not ferment with the two latter fubftances.

According to certain analyfis it contains 50 parts filiceous, 20 argillaceous, 8 calcareous earth, and 22 of water, and Bergman found in it befides a fmall portion of iron. It generally exhibits pyramidical cryftals, which are difpofed in a radiated manner, fo as to appear fpherical. It is found in various places, but particularly in the volcanic products, wherefore it was confidered as a volcanic product; the fineft kind is found in Iceland, in Sweden, and in the Ferroe Iflands.

Its primitive figure, according to La Metherie, feems to be cubical. It is generally found exhibiting various modifications of that figure.

It is generally found of a white pale green, filver white, and honey colour; at Adelsford in Sweden, it is found of a red colour; of a blue in Hungary in fome copper-mines; of a yellow colour near Schaafhaufen.

It is found in a ftate of decompofition, coating other ftones. It is found folid and fibrous, radicated, lamellated, reniform, ftalactitical, in drops, and of a capillary fhape, in which it is very beautiful.

* It

It is found in basalt, from Riesend, and on the coast of Antrum.

It is also found crystallized, or of regular shape.

a. Cubical, sometimes so altered by truncation, as to exhibit parallelopiped.

b. In six-sided and flat prisms.

c. In needle-shaped prismatic crystals, disposed in a diverging manner. The prisms are four-sided, terminating in two or four-sided pyramids.

d. Of a prismatic and capillary figure, it is found in the cavities of volcanic stones.

e. Of rhomboidal figure, with the one angle of 74, and the other 106.

SPEC. XXXI.

LAPIS LAZULI.

WALLER. *Zeolite particulis subtilissimis colore albo et cæruleo argentum continens.*

GMEL. *Lazurus.*

French. *Pierre d'azur.*

CRONSTEDT. *Zeolithes particulis impalpabilibus argento et ferro mixtus.*

This stone has probably its name from the Arabian language, in which *azul* signifies *sky-blue*.

It

It has been differently arranged; ſome mineralogiſts have conſidered it as a variety of the zeolites.

Gmelin has placed it among the calcareous ſtones; others have ranked it among the iron-ſtones.

Cronſtedt obſerved that it reſembled moſt the zeolites, which it certainly does.

Its ſpec. gr. varies, but generally = 2,100 or 2,771.

It differs from the zeolite in containing ſelenite as a component part, and alſo iron.

It is opaque, and never found cryſtallized. It generally is found in ſolid maſſes, ſeldom pure, generally full of veins of quartz, lime-ſtone, and marcaſite or pyrites.

Its colour is ſky-blue, which it retains in the fire for a long time, but at laſt it becomes brown.

The beſt kind, when calcined and immerſed in vinegar, improves in colour.

It melts eaſily in the fire, into a white frothy ſlag.

It does not efferveſce with acids, except it contains lime-ſtone.

It is not very hard, ſo that its ſurface can be ſcraped with a knife, and when it ſtrikes fire with ſteel, it is owing to the pyrites and quartz which are often found mixed with it, but it is generally harder than moſt kinds of zeolites, and takes a poliſh. When boiled in concentrated vitriolic acids, it diſſolves ſlowly, and loſes its colour.

Volatile alkali extracts no blue colour from it; and the colour seems to arise from the iron particles or pyrites.

It decomposes sooner than the zeolite, when exposed to the air; when broken it exhibits a dull surface.

It is found with the Bucharian Calmucks, in Asia, as on the Altai and in Kultach; in Persia Natolien in the Eastern countries; in Hungary, Italy, Bohemia, Saxony, Tyrol, England, and in America at Atakama in Chili, generally in large layers, or forming part of rocks. It is used for extracting that fine colour called ultramarine from; it is also manufactured into various vessels, and used in mosaic works, &c.

The lapis armenius is considered to be a different stone by the ancients, called *chrysocolla, oriental saphir*; Fr. *verd-azur*; Germ. *mountain-blue* or *berg-blau.* It is much softer than the real lapis lazuli, almost softer than marble. It decomposes sooner than the lapis lazuli, and is of a blueish colour, which however soon changes into green and grey.

It never contains pyrites. The colour which is extracted from it is much inferior to the ultramarine, and changes very soon. It is found in England and Tyrol, in large pieces, and in nests.

GENUS IV.

ARGILLACEOUS GENUS.

Or Earth and Stones, moſtly conſiſting of Argillaceous Earth.

THE earth and ſtones which are deſcribed under this head, are never found to conſiſt merely of argillaceous earth, which may be conſidered as the baſis of them; they are found mixed with more or leſs ſilex, magneſian and calcareous earth, and occaſionally oxyd of iron. But the other ſubſtances are generally ſo ſlightly combined with the baſis, that the argillaceous earth can be extracted from them, by ſulphuric acid, with which it forms Alum.

Though the ſtones ranked under this genus, differ amongſt themſelves very much in their appearance, however they exhibit in general ſome characters by which they may be diſtinguiſhed from thoſe of the foregoing genus.

Very few of them exhibit a vitreous appearance, or ſtrike fire with ſteel, except ſuch as have been rendered hard by fire.

They have generally an arid or earthy appearance when broken, and emit a peculiar earthy ſmell, when moiſtened; they become very hard when expoſed to a ſtrong heat; they hardly efferveſce with acids, a few only excepted, which contain a little carbonic acid, and this may be accounted for, from the admixture of other ſubſtances which they contain; as the baſis, namely the argillaceous earth, diſcovers no affinity to carbonic acid.

The ſofter kind adheres more or leſs to the tongue, abſorbs water, ſome of them, with a noiſe; they become more or leſs ſoft, when mixed with water; and by virtue of coherency, clays retain humidity, on which perhaps their chief power of promoting the growth of plants depends; they ſeldom exhibit a *regular ſhape*, and ſeldom what we have called, a *particular ſhape*; they are more or leſs greaſy to the touch, and the hardeſt kind can be ſcratched with a hard knife.

As to the other chemical properties of the baſis of theſe ſtones, they are mentioned in the firſt part of this work.

The

The ſchiſtous kind contains impreſſions of plants. All the ſubſtances belonging to this genus, may be divided into two general diviſions.

1. Into ſuch as we ſhall call clays, and which are more or leſs ſoft.

2. Into ſuch as are more or leſs indurated, and exhibit ſometimes a regular figure.

The clays we ſhall again divide,

1. Into ſuch as have an arid appearance, and efferveſce a little with acid.

2. Into ſuch as are ſoapy to the touch, and do not efferveſce with acids.

3. Such as have an admixture of bitumen.

4. Such as contain ſulphuric acid, in the ſtate of alum. And

5. Such as contain a greater portion of ſilex, and are found according to their degree of combination, of a more or leſs degree of hardneſs.

I. DIVISION.

The ſubſtances belonging to this diviſion, are generally of a milk-white colour, efferveſce a little with acids. They are ſoluble in nitric acid, and are in that ſtate ſeparated again by ſulphuric acid in the ſtate of alum; to this belong

SPEC. I.

PIPE CLAY.

Waller. *Argilla Apyra.*

Germ. *Pfeiffen Erde.*

Its colour is white, it is very little greaſy to the touch, friable, and ſtains the fingers. It effervefces a little with acids; when kneaded with water, it becomes clammy, ſo as to be fit for moulding into different veſſels, which when expoſed to heat, become hard, and the ſurface only becomes a little vitrified, when expoſed to a very ſtrong heat.

When firſt expoſed to heat, it becomes greyiſh or blackiſh, owing to the inflammable matter which it often contains, but by the continued heat, it is deprived of it, and becomes perfectly white.

It is uſed for tobacco pipes, and that which is moſt clammy, is found to be the beſt for that purpoſe.

When this clay is mixed with ſand, it ſerves for making crucibles, or other veſſels which reſiſt a very ſtrong heat. It is found in in Normandy, and the environs of Cologne, in Livonia, and in various other parts of the world.

SPEC. II.

PORCELANE CLAY.

Gmel. *Argilla Porcelana.*

Waller. *Argilla Apyra macra pura.*

French. *Terre a Porcelaine.*

Kaolin, by the Chineſe.

Its colour is generally white, ſometimes inclining to greyiſh—yellowiſh—and reddiſh white.

It has an arid appearance, is ſoft to the touch; when expoſed to heat, it does not change its colour, and becomes perfectly white, efferveſces leſs with acid, than the foregoing kind; it contains half its weight of ſilic. earth, on which account, when firſt mixed with water, and moulded into certain veſſels, and then expoſed to a ſtrong heat, it aſſumes the appearance and nature of a ſemi-tranſparent glaſs; ſtrikes fire with ſteel; is not acted upon by acids; and ſuffers no alteration or change as to its ſhape.

 On

On account of this property, it is uſed for china-ware, which will bear a ſudden change of hot and cold water. It ſeems to originate from the decompoſed feldſpar. It is found pure in *Japan*, in great quantity, alſo in *China*; but that from the latter country, contains micaceous particles.

In Saxony it is found of a fleſh colour, of which the porcelane is there made. It is alſo found in other parts of Germany, particularly in Auſtria, where it is uſed for the ſame purpoſe; but being rather of an inferior kind, to that of *Meiſſen* and *Berlin*, it is diſtinguiſhed by the name of *Fayence.*

A very fine white ſort is frequently found in the Ukraine, near Gluchow, which is uſed in the china manufactory at Moſcovia. Another kind is found in Siberia, in the province Tſchebarkul, which is uſed in the manufactory of St. Peterſburg. Another kind of ſtraw colour is found near Tſchebarkul, which becomes red when expoſed to heat, and may be uſed to imitate the brown chineſe ware.

SPEC.

SPEC. III.

NATIVE ARGILLACEOUS EARTH, or PURE CLAY.

Lat. *Lac Lunæ, Agaricus Saxatilis.*

Gmel. *Terra aluminaris nativa.*

Germ. *Mond-Milch, Mehl Kreide.*

Born. *Catal. raiſonné. Allumine Native pure & blanche.*

This earth has generally been ranked amongſt the calcar. earths. It is of a milk white colour, has an arid appearance, is earthy to the touch, and ſtains the fingers; is light and friable, hardly efferveſces with acids. It is found to be compoſed according to Schreber, of argil. a little calcar.—and ferugenous earth, combined with carbonic acid.

Its ſpec. gr. is equal = 1,669.

A red kind is found in Gothland, the white kind is found near Roedon in Yemteland, Timmerdala, in Weſtro Gothia, Smoland, and Ooſtro Gothia. In the iſle of Gothland, in the Baltic; it is found at the bottom of ſtagnant waters, and in the ſea.

It is alſo found in kidney ſhaped pieces, and becomes a little ſemitranſparent, when ſoftened with hot water; in the Sileſian Principality of Münſterberg, in England, in Lombardy; alſo in the garden belonging to the Pedagogio at Halle, but this contains a little quartz, ſand, and ſelenite.

SPEC. IV.

LITHOMARGE.

Gmel. *Argilla Lithomarga.*

Waller. *Archilla Lapidea.*

Germ. *Steinmark.*

This ſubſtance has a white or yellow colour, a fine texture, of different degrees of coherency or hardneſs. It is ſoluble in nitric acid with efferveſcence. It alters its colour in the fire, becomes very hard, and melts by increaſed heat, into a red porous ſlag reſembling lava. It is found in clay and limeſtone rocks, in long layers, between clay and lime-ſtone. Mr. Volta mentions, that it is found, though very ſcarce, in eight ſided priſmatic cryſtals, called Marga cryſtalliſata octoedra, by *Hardinger.* Alſo in four ſided priſms called by Waller. *Tophus ludus Helmontii.*

It

It is uſed in potteries and china-ware manufactories.

Mr. *Werner* divides the Lithomarge into two varieties.

VAR. 1. FRIABLE LITHOMARGE.

Its colour is yellowiſh, greyiſh, or whitiſh; its texture is glittering, ſcaly, the particles are moſtly coherent, ſeldom quite looſe.

It adheres to the tongue; it is found in neſts in other ſtones, viz. in grey wacke on the Harz.

VAR. 2. INDURATED LITHOMARGE.

This kind is either yellowiſh white, pearl grey, violet blue, fleſh and browniſh red, ochre yellow, cream colour, lavender blue, or liver brown.

It approaches to the nature of mountain ſoap, as it adheres ſtronger to the tongue than the other kinds of lithomarge; it exhibits often various colours, in one piece, as the *terra miraculoſa* from Saxony.

When rubbed in the dark with a pen, it emits a phoſphoreſcent light.

It is found in ſolid maſſes, having an arid appearance, and when broken, it exhibits a conchoidal ſurface.

It

It is perfectly opaque, adheres to the tongue, ſoſtens difficultly in water, and abſorbs it with a noiſe. It is generally found in ſmall quantities, except at Planitz near Zwickau, where it is found over coal flötz in pretty large maſſes of fleſh colour. Near Rochlitz, it is found in porphyry; in ſerpentine, at Zöblitz. In larger quantities, it is found in the gangues of tinſtone, at Ehrenfriederſdorf and Altenberg.

II. DIVISION.

This includes thoſe kinds of clays, which are ſoft and ſoapy to the touch, abſorb the water rapidly, and retain it for a long time; when kneaded with water, become clammy and harden in the fire. They decompoſe nitre and common ſalt, like the vitriolic acid, when diſtilled together, on account of their having a ſtronger affinity to the alcaline ſalts, than the acids with which they undergo a vitrification.

SPEC.

SPEC. V.

COMMON CLAY, BRICK CLAY, POTTERS CLAY.

Lat. *Argilla vulgaris plaſtica.*

Its colour is generally pale, ſometimes deep and greeniſh white, pale yellowiſh grey, deep blueiſh, and ſmoke-grey. It is found in large layers, and forms ſometimes the bed of rivers, and according to ſome authors, the bottom of the ocean is alſo compoſed of it.

It has a dull appearance; when broken, it exhibits partly a fine, partly a coarſe texture, is ſoft, and when moiſtened, it becomes ſoapy to the touch, and adheres to the fingers; when expoſed to a ſtrong heat, it becomes red, and by a very ſtrong fire, melts into a ſlag.

When moiſt and expoſed to the ſun, it ſhrinks and cracks irregularly in all directions. It does not efferveſce with acids, is frequently mixed with iron ochre, alſo vitriolic acid and ſand. As its compoſition is not always the ſame, it is neceſſary to mix it with other clays or ſand, in order to make tiles of it; the more ſand incorporated with it, the better are the tiles, as they vitrify more readily, and abſorb

leſs

lefs water. When the mixture is well chofen, the tiles muft not bend when red hot, nor fhould they crack; they muft be fonorous, and not attract moifture. The blueifh kind is for that purpofe the beft. It is ufed inftead of lime for mortar, bricks, and for other purpofes in the earthen ware manufactories.

SPEC. VI.

MARTIAL CLAY, PAINTERS CLAY.

Germ. *Mahler Thon.*

Lat. *Argilla pittoria.*

Waller. *Argilla mineralis.*

This kind is rather a little rough to the touch, more dry than the common clay, has a difagreeable fmell, abforbs and mixes with water with a noife, foftens flowly, and alters its colour. It contains the ferugenous earth in different proportions, hence its different colours. It is found in clifts of the clayey and ferugenous mountains, and feems to originate from the decompofition of ores and iron pyrites. The *umbra earth* belongs alfo to this kind, which is found on the clay fhores near Roptfch in Ingermania, &c.

And

And alſo the *green earth* (*Argilla veronenſis*) Germ. *Grünerde.* Ital. *Terra verde di Verona.* French. *Terre Verte,* which is found of a globular form in the almond ſtone of the Wacke kind. It is found at Planitz near Zwickau, alſo frequently on the *Monte Baldo,* in the environs of Verona, in Tyrol and in Bohemia. It has yielded by analyſis 20 argill. 8 calcar. 3 ſilic. $3\frac{1}{2}$ magneſian earth, and 1, 2 iron.

Alſo the yellow earth, which is found in Werau in Upper Lauſatia on the Ziegelberg. The *Terra Miraculoſa.* Germ. *Wundererde,* which is found in Saxony, and which has its various colours from the metallic earth altered by the air, belongs to this ſpecies.

SPEC. VII.

BOLE.

Lat. *Bolus.*

Born. *Argile martiale et Lithomarge.*

This ſubſtance is found of different colours in the clay mountains in Germany; the red kind is called *Armenian Bole,* which is uſed for red pencils. The Terra Lemnia, which is compoſed of 47 ſilic. 21 argil. 0, 2 magneſian

5, 4

5, 4 calcar. earth, 5 iron and 17 of water, belongs alſo to this kind. The particles of the bole are very ſmall, and cohere very ſlightly; it ſoftens on the tongue, and adheres a little to it; it ſoftens eaſily in water, but is not fit for pottery. It abſorbs water, it hardens in fire, and is then attracted by the magnet; melts into glaſs by a ſtrong heat.

To the indurated or harder kind, belongs the red chalk (Fr. *Crayon rouge)* which has an arid appearance; is ſomewhat hard and brittle, and intimately mixed with oxyd of iron.

The red boles are found in Ruſſian Finland, on the frontiers of Sweden, in Livonia, the Crimea, and the Ural.

The *Terra Sigillata*, which is kept in apothecarys' ſhops, is of this kind, but of the fineſt ſort: it is moulded into flat round pieces, with an impreſſion in order to prevent its imitation.

SPEC.

SPEC. VIII.

SOAP ROCK. *Fullers earth, mountain ſoap.*

Germ. *Seifen Thon.*

Born. *Argile ſavoneuſe.*

This is of a grey or yellowiſh colour, is dry, rather hard, however it can be ſcratched with the nails; it is ſhining when ſcraped with a knife, and ſlippery between the fingers, or ſoapy to the touch; it adheres ſtrongly to the tongue. When beaten with water, it makes a lather like ſoap; it has alſo the property to combine with fat ſubſtances; it does not ſtain the fingers; falls to powder when expoſed to the air; ſoftens in water, and hardens in the fire.

It contains magneſia, from which it has its ſoapy property; it is frequently found in England, and in various parts of Germany, Bohemia, and Poland. The beſt kind is found in England. It was uſed by the ancients to bleach linen, and is ſtill uſed for that purpoſe by the inhabitants of the Crimea and others.

Some of the indurated clays are compoſed of layers, or have a ſlaty texture, viz.

SPEC.

SPEC. IX.

SLATY CLAY.

Germ. *Schiefer Thon.*

Lat. *Argilla vulgaris ſchiſtoſa.*

Its colour is generally blueiſh and aſh grey, or greyiſh black. It is found ſolid, generally in large layers; when broken, it has a dull appearance, very ſeldom glittering. Its texture is ſlaty, it is opaque, ſoft, adheres a little to the tongue, and contains frequently impreſſions of plants, ſuch as *equiſitum, adianthum nigrum,* and various ſilices. It is found over and under the coal flötz, ſometimes penetrated with bitumen; another kind compoſed of thin layers, containing more ſilic earth, viz.

SPEC. X.

ARGILLACEOUS SCHISTUS.

Germ. *Thonſchiefer.*

French. *Ardoiſe argilleuſe.*

This is harder than the foregoing, and is found of various colours, generally greyiſh black, greeniſh, blueiſh, yellowiſh, and reddiſh

diſh grey, ſeldom of a deep crimſon red colour, and very ſeldom ſpotted. It is found ſolid and interſperſed, generally in layers, and gangues; It forms beſides the grey wacke, the principal rocks on the Harz (and ſo ſeems the Killas, one of the general gangues of the tin ores in Cornwall, to be of the ſame nature, containing partly mica and quartz intermixed.) When broken, it is ſometimes a little ſhining; has ſeldom a perfectly dull appearance; ſometimes exhibits a ſilky or metallic luſtre. Its texture ſometimes appears curved or undulated; the fragments are generally orbicular, ſeldom long ſhivery, trapezoid, and very ſeldom rhomboid. It leaves a greyiſh white trace upon the touchſtone, feels a little greaſy; when powdered, it is acted upon by acids.

It is compoſed, according to Kirwan, of 60 ſilic. 25 argill. 9 magneſian earth, and 6 of iron. It is frequently found in Saxony, compoſing a conſiderable part of the primitive mountains. At Gerſdorf, it is found of a blueiſh grey colour, reſting upon gneis.

The beſt varieties, reſpecting colours, are found near Schneeberg. It is uſed for covering roofs.

DIVISION III.

Argillaceous ſtones, containing bitumen, or *petroleum, called*

SPEC. XI.

BITUMINOUS SHISTUS.

Germ. *Brandſchiefer.*

This ſtone is generally of a browniſh black colour. It is found ſolid, forming flötz or ſtratified mountains. When broken, it is a little glittering, has a ſlaty texture, and breaks in orbicular plates; is opaque, ſoft, a little greaſy to the touch, and when expoſed between red hot charcoal, it becomes white, and emits a ſtrong ſmell. It ſeems to be compoſed of argillaceous ſhiſtus, penetrated with bitumen, and ſulphur-pyrites.

It is only found in flötz mountains, viz. at Werau in Upper Lauſatia, at Wettin in Heſſe. In Yorkſhire; it is ſtrongly impregnated with bitumen, ſo as to burn like coals.

DIVISION IV.

Argillaceous earth united to ſulphuric acid.

SPEC.

SPEC. XII.

ALUMINOUS EARTH.

French. *Terre alumineuſe.*

Germ. *Alaun Erde.*

It is generally found of a deep grey, brown, or blackiſh colour; has a dull appearance, ſeldom a little glittering, originates from decompoſed aluminous ſhiſtus; it is diſtinguiſhed by the efflorefcence of alum, and is found in flötz and aluvian mountains, as at Moſcovia, Upper Luſatia, where it is uſed for the alum manufactory.

SPEC. XIII.

ALUMINOUS SHISTUS.

Germ. *Alaun Schiefer.*

French. *Ardoiſe alumineuſe.*

Lat. *Argilla Schiſtus aluminaris.*

Var. 1. Common Aluminous Shistus.

Its colour is blueiſh black; it is found ſolid, and in globular maſſes; when broken, it is a little glittering; has a ſlaty texture partly ſtraight, partly curved; it breaks in trapezoid pieces, gives a black trace, is generally ſoft, and has a ſweetiſh nauſeous taſte. It is found generally accompanying coals; it ſeems to be argillaceous ſhiſtus, penetrated with ſulphuric acid. It is found in Norwegue, Sweden, Scotland, England, and in various parts of Germany.

It is alſo employed for alum works.

VAR. 2. GLOSSY ALUMINOUS SHISTUS.

Germ. *Glänzender Alaun Schiefer.*

Lat. *Argilla Aluminaris Schiſtoſa nitida.*

This kind is generally blueiſh black, ſometimes iron black; is found ſolid in large layers, and exhibits ſomewhat of a metallic luſtre; its texture is ſlaty, it breaks into indeterminately ſhaped pieces, is a little greaſy to the touch, is partly ſoft, partly hard; it is compoſed of argillaceous earth, vitriolic acid, ferugenous earth, and a little combuſtible matter; it is found at Reichenbach, Saalfeld, and other places.

SPEC.

SPEC. XIV.

ROCK-ALUM.

Germ. *Alaun ſtein.*

French. *Pierre calcaire alumineuſe.*

Its colour is yellowiſh, greyiſh, reddiſh, ſometimes white, reſembling chalk, adheres to the tongue, and conſiſts of 22 ſilic. 35 alum. earth, and 43 of ſulphur.

It is found near Tolfa in the dominions of the Pope, and is conſidered as the beſt alum ſtone; it forms there mountains, containing gangues of quartz. It is alſo found in a certain part of Tuſcany.

SPEC. XV.

BLACK CHALK.

Germ. *Zeichen Schiefer,* or *ſchwarze Kreide.*

Lat. *Argilla nigrica.*

French. *Crayon noire.*

Its colour is greyiſh black, ſometimes blue-iſh black, is always found ſolid, when broken has a dull appearance; its texture is curved, ſlaty, opaque; it is uſed for drawing, is ſoft, becomes red in the fire, and is then called soft bloodstone; it contains besides the vitriolic acid, inflammable matter, and iron. The best kind is found in Italy.

DIVISION V.

Argillaceous Earths united to a greater portion of Silex, and are therefore of a harder nature.

SPEC. XVI.

WHETSTONE.

Germ. *Wetzschiefer.*

Lat. *Argilla coticula.*

French. *Pierre a Rasoir.*

Its colour is generally greenish grey, seldom spotted; it is found solid in large layers, when broken, the surface appears a little glossy; its texture is slaty, approaching to shivery; it breaks in orbicular plates, is a little semitransparent on the edges, it gives a greyish white trace, does not adhere to the tongue.

The best kind is found in the Levante; near Lauenstein in Bareith, in Siberia on Tom; near Freiberg in Saxony.

SPEC. XVII.

TRIPOLI.

Germ. *Trippel.*
French. *Terre de Tripoly.*
Lat. *Argilla Tripolitana.*
Waller. *Tripola ſolida.*

This ſtone has its name from a place called *Tripoli*, whence it was firſt brought to us.

Its colour is whitiſh, yellowiſh grey, cream and ochre yellow; is found ſolid, has a dull and earthy appearance when broken; it breaks in indeterminate obtuſe angular pieces, is ſoft and ſandy between the teeth, abſorbs water with a noiſe, during which air bubbles are expelled, is harder than the other clays, and may be eaſily powdered; it is not readily acted upon by acids; when expoſed to ſtrong heat, it becomes white, and melts with chalk in fire.

Its ſpecif. gravity = 2080.

It contains 66 parts of ſilic. 7 argill. 1,5 magneſian, 1,3 calcar. earth, 2,5 iron, and 19 of water. It is found in the iſland Tanna, in the ſouth ſea, and in the north of Africa, at Naples, in Saxony at Potſchappel near Dreſden, in the environs of Naumburg, in Bohemia, and in various other German provinces.

It is much ufed for polifhing; it is fuppofed by fome mineralogifts to be of volcanic origin.

SPEC. XVIII.

MICA, GLIST.

Germ. *Glimmer.*

Lat. *Argilla mica.*

This Subftance which exhibits a lamellated ftructure, is found of various colours, moft commonly greyifh, blackifh, yellowifh brown, filver white, alfo of the tombac colour; it is found in folid maffes, but never forms whole rocks; it is found of irregular fhape, interfperfed through other ftones, particularly in the granits, of which it is a component part; and fometimes it is found of regular form.

It is always fhining; fometimes it exhibits a metallic luftre; it eafily divides into thin lamellæ, which are either ftraight, curved, or undulated, feldom radiated.

The laminæ are fometimes found of confiderable fize; it is generally femitranfparent, except a fpecies of it, the *Mufcovy glafs*, when in thin laminæ, is quite tranfparent; its furface ſurface can be ſcratched with a knife; the lamellæ are flexible and elaſtic.

Its ſpecif. gr. varies generally = 2934: 1000.

It is not readily acted upon by acids; by means of the blow pipe it is not quite ſoluble in ſoda, and it melts with microcoſmic ſalt and borax without ebulition. The white kind melts very difficultly, but the black kind eaſily, probably on account of the iron which it contains. On analyſis it has yielded different component parts, and alſo in different proportions. The ſilver white kind has yielded 40 parts of ſilic. 46 argill. 0,5 of magneſian earths, and 9 of iron.

The Muſcovite mica has yielded 50 parts ſilic. 45 magneſian, and 0,5 of argill. earth.

That which is found of regular ſhape, compoſed of ſix ſided lamellæ, from Altenberg in Saxony, has yielded 40 ſilic. 46 argill. 0,5 magneſian earth, 0,9 manganeſe.

Mica is found in various places in Siberia, on the alps in Tyrol, Zitterthal, and Altenberg in Saxony, and Zinnwalde, moſt frequently in granits and gneiſs.

Its regular figure is the ſix ſided plate with the angles of 120°, but it exhibits ſometimes four

four ſided and ſix ſided columns compoſed of lamellæ.

The yellow kind with a metallic luſtre, is called in German, Katzengold, and the ſilver white, Katzenſilber.

That which is found in Siberia in large thin plates, is uſed for windows, and upon other occaſions, where panes of glaſs are wanted.

SPEC. XIX.

CIANIT.

Werner. *Talcum cyanites.*

Germ. *Kyanit.*

By Sauſſure. *Sappare.*

Gmel. *Zeolithus cyanitus.*

This ſtone is compoſed of long laminæ, of a milk white colour, with ſhades of ſky or Pruſſian blue; it has a luſtre ſimilar to mother of pearls; the lamellæ are ſemitranſparent in different degrees, rather brittle; it is rather ſoft and can be ſcraped with a hard knife; to the touch it reſembles ſomewhat the harder kind of talc.

Its ſpecif. gr. = 3517.

It melts *per ſe* very difficultly in fire, and does

does not loſe its colour. It is not readily acted upon by nitric, and muriatic acid.

Mr. Sauſſure found by analyſing it, 13 part ſilic. 67 argill. 13 magneſian, and 5 of feruginous earth; others have found, beſides thoſe component parts, a little calcar. earth.

Its matrix is generally granit and gneiſs; it is found near Lyon, on St. Gotthard, at Zitterthal in Tyrol, on the Carpathian mountains, at Nertſchink in Siberia, and in Tranſilvania, alſo in Scotland.

It is found in ſolid maſſes, exhibiting no particular ſhape, and the lamellæ are long, of different breadths, irregularly placed, one over the other, ſometimes in a radiated manner; this kind is found in Scotland.

Of regular ſhape it is found on St. Gotthard's, and in the aforementioned places.

This kind is more tranſparent, becomes opaque in the fire; its regular figure is an oblong four ſided priſm, compoſed of lamellæ placed longitudinally; the ſurface is longitudinally ſtriated; it differs much from the ſhörls, by the different degrees of the ſide angles.

SPEC.

SPEC. XX.

HORNBLENDE.

Lat. *Argilla Hornblenda.*

French. *Roche de Corne Striée.*

Swed. *Strahlkimmer.*

De Lisle and Born. *Shörl feuilleté.*

The name Hornblende, was formerly given to those kinds of shörls, which exhibited a spatious foliated appearance, and a green or black colour. This stone is found of various degrees of hardness, but never so hard as to strike fire with steel; its surface cannot be scraped with a knife, when dipped into hot water, it emits a clay smell, is difficult to be reduced into powder, on account of its toughness, in which it resembles horn; it melts per se.

Mr. Werner describes four varieties.

Var. i. Common Hornblende.

Lat. *Argilla hornblenda vulgaris.*

Waller. *Corneus facie spathosa striata.*

Cronstedt. *Bolus indurata particulis squamosis.*

This

This is found blackiſh, and of a deep green colour, moſtly opaque; it is found in ſolid maſſes, interſperſed through other ſtones, alſo cryſtalliſed of priſmatic figure; in its cryſtalliſed ſtate, it is ſubject to the following modifications:

1. Exhibits ſix ſided priſms, the ends accuminated by three faces.

2. Six ſided priſms terminating by one end in a three ſided pyramid, and on the other end, exhibiting two faces.

3. Six ſided priſms terminating on one end by four faces, the other end exhibiting many faces.

4. Six ſided priſms on both ends, terminating in three ſided pyramids, having the edges truncated.

5. Eight ſided priſmatic on both ends, terminating by two faces.

The cryſtals are internally ſhining; the texture exhibits divergent radiations. It is ſometimes foliated, and the lamellæ are either parallel or curved.

It differs from the ſhörl, which has a ſhivery texture, and the hornblende is either radiated or foliated; it differs alſo from it with regard to its cryſtalliſation. The cryſtals of ſhörl are longitudinally ſtriated, thoſe of hornblende

tranſ-

transſverſally; the hornblende is ſofter than the ſhörls.

The hornblende is found mixed with trapp baſalt, and that kind of granit which Mr. Werner calls *Sienit.*

It is frequently found in Saxony, in Upper Luſatia, and in Joachimſthal in Bohemia, in Sweden, &c.

It has yielded by analyſis 52 ſilic. 23, 33 argill. 6 calcar. earth, and 17, 5 iron.

VAR. 2. HORNBLENDE SHISTUS.

Germ. *Hornblende Schiefer.*

Lat. *Argilla Hornblenda Schiſtoſa.*

This kind is of a greyiſh black, ſeldom deep green colour, is found in whole layers, in rocks of gneiſs, and micaceous ſhiſtus; when freſh broken, its ſurface is ſhining, its texture appears irregularly radiated. It is brittle and compact. It is found in various places near Freyberg, &c.

VAR. 3. LABRADOR HORNBLENDE.

Its colour is generally greyiſh black, ſometimes a little ſhade of copper-red, a little reſembling Labrador ſtone. Its texture is lamellated;

mellated, the lamella often curved, a little ſemi-tranſparent on the edges.

It is found on the coaſt of Labrador.

Var. 4. Basalt Hornblende.

Lat. *Argilla Hornblenda Baſaltica.*

Its colour is blackiſh green, ſometimes deep black. Is only found cryſtalliſed in 6 and 8 ſided priſms, cuniated on the ends.

When broken, its ſurface is ſhining; when longitudinally broken, the lamellæ parallel.

It is found in baſalt, tuff, wacke, and lava.

It has yielded by analyſis 58 ſilic. 27 argil. 1 magneſian, 4 calcar. earth, and 9 iron.

SPEC. XXI.

TRAPP.

Waller. *Corneus Trapezius.*

This ſtone is by ſome mineralogiſts conſidered as a variety of the baſaltes, which it reſembles in many reſpects; but, as it exhibits ſome marks by which it may be diſtinguiſhed, it may be placed here with ſome propriety, though I ſhall have occaſion of mentioning it again, by the component parts of the mixed rocks.

Its

Its name originates from the Swedish language. The term *trapp* describes a stone, which breaks in pieces of a rhomboidal figure, and consequently exhibits, when in the state of rocks, steps like a stair case.

Its colour is blackish brown, blackish grey, and blackish green; in hardness it varies; it generally scratches glass.

Its specific gr. = 2,745.

It is never found of regular shape; it melts into a glass, and may be used for the common green glass.

It generally effervesces with acids, and can with greater ease be reduced to powder than basalt. It emits no earthy smell when moistened. By analysis it has yielded 52 silic. 15 argill. 0, 8 calcar. earth, and 16 iron.

It contains frequently other stones, as hornblende, mica, chalcedony, calcareous spar, as the toad-stone in Derbyshire; hence its porous appearance, which it exhibits occasionally, when either of the substances are decomposed.

It is generally found in the gangues and flötz mountains; sometimes it forms the basis of basalt rocks, and it contains occasionally veins of ore.

It is, perhaps, by subterraneous fire, changed into basalt.

A softer

A ſofter kind of this ſtone, of a brown or reddiſh colour, is called *Wacke*, on the Erzgebürge, occurs frequently in Bohemia.

SPEC. XXII.

BASALT.

Lat. *Baſaltes.*

This ſtone has lately been much noticed, and certain mineralogiſts conſidered it to be trapp, which has been altered by the ſubterraneous fire; and according to the variety of that ſtone, the baſalt exhibits various colours; it muſt alſo hence obtain a different texture, gravity, and hardneſs.

Sometimes it is found ſo little altered, that it can hardly be diſtinguiſhed from trapp or wacke.

Its colour is generally greyiſh black, alſo greeniſh black, perfectly opaque. It is often found ſo hard, as to ſtrike fire with ſteel; and takes a good poliſh; it is not readily acted upon by nitric acids, and melts into a blackiſh glaſs, before the blow-pipe.

Its ſpecific gr. is generally = 2,743.

So is that baſaltes which is found at the Giants Cauſeway. It has yielded by analyſis 50 parts ſilic. 15 argill. 2 magneſian, 8 calcar. earth, and 25 of iron.

The baſalt is found in ſolid maſſes, alſo column ſhaped, and the columns are frequently found placed perpendicularly over granit, gneiſs, lime-ſtone, and bituminous wood.

The baſalt forms often iſolated mountains of a conical figure.

The columns are not regular, or the number of ſides is found various, exhibiting no particular marks of cryſtalliſation.

As to its origin, mineralogiſts differ in their opinion.

From a variety of characters, as well as from its appearance and component parts, it may be ſuppoſed to be produced by ſubterraneous fire; or it may be conſidered as of volcanic origin, in which caſe, its component parts, which, by fire, were reduced to a fluid ſtate, on cooling, cracked into column ſhaped pieces.

Baſaltes have lately been diſcovered, which have holes through them, ſimilar to pumice, and the cavities contain often cryſtalliſed ſtones; but it appears upon the whole, that ſome baſaltes are formed in the moiſt way, or, at leaſt, water has contributed ſomething to their formation; and that others are of a volcanic origin.

The

The volcanoes of the preſent time form no baſaltes; perhaps the time when the baſaltes were formed, was, when the ſurface of the earth was covered with water, which cooled the heated maſs, and after the retroceſſion of the water, occaſioned its cracks or columnar diviſions.

SPEC. XXIII.

TUFFWACKE.

Under this name Prof. Blumenbach ranges all the light, ſoft, partly porus, partly veſiculous, or ſpongy ſtones, that are moſtly of a grey or browniſh colour. They are found frequently near baſaltes, and volcanic lavas; which, by certain changes, approach to their nature. They contain often hornblende, olivin, white garnits and pumice.

To the friable kind belong the *Traſs*, or *Tarras*, found on the Rhine, and alſo that ſtone which is thrown our by Mount Veſuvius; and from which Pompeja was built, it is called *Tufa*, by the Italians.

The Traſs, by Waller, *Cæmentum Tarras*, is a yellow, petrified, porous, ſandy, and feruginous earth, containing often particles of other ſtones. There are other ſtones which may be placed with theſe ſtones; but they are noticed in that part of the work which treats of rocks, &c.

SPEC. XXIV.

PUMICE STONE. PUMEX.

Germ. *Bimſtein.*

French. *Pierre ponce.*

Waller. *Porus igneus.*

Gmel. *Lava pumex.*

This is a ſlight ſpongy ſtone, generally of greyiſh, blackiſh, brown reddiſh yellowiſh, colour; is ſharp or rough to the touch, has a fibrous texture.

Its ſpecif. gr. = 0,914 : 1000.

It does not efferveſce with acids, melts into a ſlag, has all the appearance of having been expoſed to the action of ſubterraneous fire.

It is found in the aſhes near Veſuvius, from whence it is waſhed down into the ſea.

It is uſed for ſcouring, or cleaning the ſurface of hard metals, or other ſubſtances.

A certain kind has yielded by analyſis, 11,66 ſilic. 82,5 argill. 4,58 calcar. earth, and 1,66 iron.

SPEC. XXV.

LAVA. *Argilla Lava.*

The ſtones belonging to this ſpecies, have been expoſed and altered by the ſubterraneous fire of the volcanoes; they differ in appearance and

and nature, according to the ſubſtances of which they were compoſed, previouſly to their having been melted by the fire; moſt of them have a vitreous appearance, more or leſs, according to the degree of heat.

They may be divided into three kinds.

VAR. 1. SPONGY OF POROUS LAVA.

This kind is a hard, heavy, vitreous ſlag, which flows from the crata of Veſuvius. The ſurface is quite vitreous, uneven, porous, and veſicular; ſometimes ſtalactitical; it is uſed for plaſtering, &c.

VAR. 2. COMPACT LAVA.

Germ. *Steinige Lava. Scoria Breccia.*
Wall. *Saxum vulcanorum.*

This kind is a compact opaque, mixed maſs, of various colours, moſtly greyiſh and reddiſh brown; contains often, *hornblende, white garnits, olivin,* alſo *calcareous ſpar, mica, ſhörl.*

VAR. 3. VITREOUS LAVA. *Scoria vitrea achates Iſlandicus.*

This kind is black, ſometimes greeniſh, a little ſemitranſparent; it breaks into conchoidal pieces, reſembling compact glaſs. This ſtone muſt not be confounded with the *obſidian* of Werner, which is electric, and not a volcanic product.

GENUS V.

MAGNESIAN GENUS.

THE ſtones which are ranked under this genus, have, for their principal conſtituent part, or baſis, the magneſian earth, whoſe diſtinguiſhing properties, when in a pure ſtate, have been mentioned in the beginning of this work.

The magneſian ſtones are always mixed with ſome other ſubſtances, generally with ſiliceous earth, a ſmall portion of calcar. earth, and more or leſs oxyd of iron; they have their colour from iron. The affinity which the magneſian earth certainly has to the carbonic acid, muſt be very weak, as there are very few ſtones of the magneſian kind, which efferveſce with mineral acids; hence the affinity of this earth to the other admixed ſubſtances, muſt be ſtronger, ſuppoſing the carbonic acid to be preſent, and not driven off by heat.

When the component parts of the magneſian ſtones are not intimately blended, the magneſian earth, if they be previouſly pulverized, can

can be extracted from them by sulphuric acid, with which it makes the So, called Epsom salt, *Sulphate of Magnesia*, which has a bitterish taste; when the magnesian earth is dissolved in nitric acid, and a paper is dipped into a saturated solution of it, it burns, when dry, with a green flame.

The magnesian earth does not melt *per se*; and when magnesian stones are found to melt, it is owing to heterogeneous substances, such as siliceous earth, or oxyd of iron, &c. These stones also melt with borax, when exposed to heat. They do not, like quick-lime, become hot when moistened with water, nor are they afterwards rendered soluble in water.

The magnesian stones form deliquescent salts, when dissolved in muriatic or nitric acid. They do not harden so much in the fire as the clays.

Most of the stones of this genus exhibit a greenish colour; most of them are greasy and soft to the touch, do not adhere to the tongue, and a few only are hard, such as the asbestus and the jade; but even these very seldom strike fire with steel. They are only semi-transparent; in different degrees, none of the magnesian stones have been found to contain petrifactions; they hardly ever exhibit a regular form.

The following ſpecies and varieties are known and diſtinguiſhed from each other by certain marks.

SPEC. I.

STEATITE SOAP STONE.

From the Greek language, *Steatos, fatty ſtone.*

Gmel. *Taleum Smectis.*

Cronſt. *Argilla indurata particulis impalpabilibus ſolida.*

French. *Pierre de Lard.*

Germ. *Speckſtein.*

Swed. *Skräddare Krita.*

Hung. *Szalonnackö.*

In this ſtone the component parts are ſo equally mixed, that they cannot be diſtinguiſhed with the naked eye. It is found of various colours, viz.

1. Light white in *Bareith* on *Fichtenberge.*

2. Greeniſh white, with deep ſhades, at the ſame place.

3. Yellowiſh white, red ſpotted, *in China.*

4. Olive green, from *Johann Georgenſtadt.*

5. Mountain green, in *Zöblitz in Saxony.*

6. Light

6. Light greenish grey, in the *Isle of Sky*, in *Scotland.*

7. Yellowish grey, in Cape Lizard, in Cornwall.

8. The lamellated kind is only found of a green colour in Zöblitz, and Norwegue, &c.

It is only semi-transparent when in thin lamellæ. It is soapy to the touch, does not adhere to the tongue—very seldom found to leave a trace on the fingers; it is rather soft, so that it may be easily cut into vessels; never so hard as not to be scratched with a knife.

The softer kind becomes harder in the air; absorbs water very slowly; does not soften in it, nor effervesce with acids.

Its specific gr. is = 2,600, 1,000.

When exposed to heat, it becomes more opaque, and loses its unctuosity. It melts with borax and soda into a green slag; it contains more siliceous earth than the talc, and is much harder; is soluble in acids, but very slowly and without effervescence. It is found in compact layers, interspersed, kidney shaped, seldom of regular shape, in six-sided prisms, terminating in six-sided pyramids. It has a shivery texture. It is found in Cornwall in England, Thiersheim on Fichtelberg. In Saxony in Johanngeorgenstadt,

ſtadt, Zöblitz, the beſt kind is found in China. That from Bareith has yielded by analyſis 58, 33 ſilic. 39, 16 magneſian earth, and 2, 5 iron.

Some mineralogiſts found Nickel in its compoſition.

Mr. Werner and Karſten make a different variety of the lamellated kind, which is found of a green colour, ſometimes on one ſide inclining to yellowiſh.

It is found in Norwegue, Zöblitz, &c.

The *Spaniſh chalk*, Germ. *Spaniſhe Kreide*, *Steatites cretaceus* belongs to the Steaites. It ſtains, and is therefore uſed for writing on ſlates.—It becomes very hard in the fire.

To the harder kind belongs the *Briançonner earth*, the *Chineſe ſmectis*, *or ſpeckſtone*, which takes a fine poliſh.

SPEC. II.

TALC TALCUM.

This is a fatty or greaſy ſubſtance, which is found of various colours, viz. yellowiſh white, greeniſh, ſilver white, and fleſh colour.

It is ſhining, and of various degrees of tranſparency; generally ſo ſoft, that impreſſion may be made on it with the nail. It is found ſolid,

ſolid, lamellated, ſcaly, and cryſtalliſed; it differs from mica which it reſembles, in this that its lamellæ are not elaſtic, and it contains leſs ſiliceous earth; when expoſed to heat, it becomes more brittle, does not efferveſce with acids, and is compoſed of magneſian and ſiliceous earths, more or leſs, intimately combined, with a little argillaceous earth.

Mr. Werner divides the talc into the three following varieties:

VAR. 1. *Earthy Talc.*

This kind is of a greeniſh white colour, ſcaly, ſhining, compact, friable, ſtains the fingers a little, is greaſy to the touch. It is found near Freiberg and Gera, in Saxony, and in Grönland

VAR. 2. *Common Talc.*

This kind is generally greeniſh and ſilver white, ſhining, has a luſtre ſimilar to mother of pearl, is ſemi-tranſparent, and ſoft, has a lamellated texture, is greaſy to the touch.

It is found ſolid interſperſed, and in thin hexagonal plates, or priſmatic.

It is eaſily divided into thin laminæ, which are flexible.

It

It is found in ſerpentine, lapis olaris, and in ſteatite, near Querbach, Silberberg and Reichenſtein in Sileſia, near Merzberg, Zöblitz, in Tyrol, near Cleven in Veltlin, near Naples, and in Switzerland.

It yields by analyſis, 50 ſilic. 45 magneſian, and 5 argill. earth.

VAR. 3. INDURATAD TALC. *Pot Stone.*

Waller. *Steatites opacus particul. micac. mixtus ſolid. &c.*

Lat. *Talcum proprium ollare.*

French. *Pierre ollaire.*

Swed. *Teloften.*

Dan. *Fedſteen.*

(Werner.) Germ. *Verhärteter Talk.*

It is generally of a pale yellowiſh and greeniſh grey, reddiſh grey, or white colour, and contains many micaceous particles; it is generally found compact, and ſo mixed that its component parts cannot be diſtinguiſhed by the naked eye; it is ſhining, has a ſoapy glittering luſtre; its texture is lamellar, and it breaks in orbicular ſhaped plates; it is a little ſemitranſparent on the edges; it is brittle, and can hardly be impreſſed with the nail; is

100

too hard for writing, but is very fit to be cut into vessels of various shapes; it is not acted upon by water, and not readily by acids; it takes a fine polish, it resembles in appearance the frozen fat oils. Its specif. gravity is generally = 2700.

It becomes hard in the fire, and is therefore wrought into various vessels or utensils for boiling water, &c. it is also made into furnaces.

That from China is the best. It is found in nests near Zöblitz and Schwarzenberg in Saxony, and near Dorfbach in Silesia, in serpentine stone; in large beds in Norway, Finland, in Tyrol, and island Elba.

By analysis it has yielded 38,12 silic. 6,66 argill. 38,54 magnesian, 0,41 calcar. earth, 15,62 iron, and 0,41 fluoric acid.

The soft stone of *Grönland*, the gilt stone of *Canton Uri*, which is cut into plates, and said to last for ever, belongs to this species.

Also the cut stone, Germ. *Schneidestein*, of Tyrol mountain, in which the bar-shörl is found, is of this kind.

SPEC. III.

CHLORIT. *Talcum chlorites.*

VAR. 1. *Chlorit Earth.* Germ. *Samt erde.*

This

This ſubſtance approaches the talc ſtones; it is of a mountain, leek and olive green colour, has a ſcaly texture, and a glittering appearance, is rather earthy to the touch; ſtains the fingers a little, is light, and diſcovers a little clay ſmell when breathed on. It yields by analyſis 437 magneſian, 357 ſilic. 128 iron, 0,41 argill. and 0,62 calcar. earth.

It is found in Saxony at Gieſhubel; in the primitive mountains, and is alſo found in rock cryſtal.

VAR. 2. CHLORIT SHISTUS.

Talcum chlorites Shiſtoſus.

Germ. *Chlorit Schiefer.*

Its colour is the medium between greeniſh grey, and mountain green.

It is found ſolid, a little ſhivery, rather a fat luſtre; its texture is ſhiſtous, ſometimes undulated; it breaks in orbicular pieces; it gives a mountain green trace, is opaque, and a little harder than the foregoing variety; it is found between the argillaceous and micaceous ſhiſtus and indurated Talc; ſometimes found mixed with quartz granit, and octoedral magnetic iron ſtone.

A very fine ſort is found in Corſica and Tyrol.

VAR.

VAR. 3. COMMON CHLORIT of Werner.

This is of an olive and mountain green colour, ſometimes blackiſh green; it is found ſolid and interſperſed, alſo coathing quartz cryſtall; appears earthy in its fracture.

SPEC. IV.

SERPENTINE.

Talcum Serpentinus.

Waller. *Steatites Serpentinus.*

This ſtone is generally found deep blackiſh, olive green, ſeldom yellow, ſometimes crimſon red, blueiſh and greeniſh grey, generally one ſpecimen exhibits various colours, like the ſkin of a ſerpent, which it reſembles, and is therefore called ſerpentine.

It is found in ſolid maſſes, ſeldom interſperſed, when broken it has a dull appearance, but takes a poliſh; it is ſmooth to the touch.

Its ſpecif. gr. = 2400.

With the nail no impreſſion can be made on it, but its ſurface can be ſcraped with a knife; it is cut into various veſſels, as mortars, cups, &c.

In the fire it becomes harder, and alters its colour; it is only ſemitranſparent on the edges, when in thin plates.

It

It forms large parts of certain rocks; it contains occaſionally quartz, ſhörl, calcareous ſpar, iron glimmer, mica, amianth, talc, lithomarge, aibeſt, lapis ollaus, and garnit.

It is found in Saxony, at Zöblitz, and near Chemntiz, &c.

It yields by analyſis, 60 ſilic. 11,1 argill. 5 magneſian, and 5,7 calcar. earth, 4,7 iron; but the proportion varies accordingly. Perhaps the Variolit might be placed here?

SPEC. V.

NEPHRITE.

Lat. *Lapis Nephriticus.*

Hipſtone. *Jade.*

French. *Jade.*

Germ. *Nierenſtein,* ſo called becauſe it was ſuppoſed to cure the pains of the kidneys.

This ſtone is the hardeſt of all this genus; its colour is greeniſh yellow, mountain and olive green, blackiſh green; it is ſemitranſparent, has an appearance as if it had imbibed oil.

It is ſmooth or ſoapy to the touch; not readily acted upon by acids; it does not melt in the ſtrongeſt fire; its texture is fine, and the fragments ſhivery.

Its

Its specif. gr. = 2600.

(That found by Mr. Hoepfner yielded by analysis, 47 silic. 4 argill. 38 magnesian, 2 calcar. earth, and 9 of iron.)

It is found in Egypt, China, in the Amazon river in America, in the mountain Altoi in Siberia, and on the Carpathian mountains.

The Pietra d'Egitto, by the Italian antiquarian, belongs to this kind, and the Punammustone from New Zeeland, of which the antipodes had made planes, chissels, and other utensils, is also of this kind.

SPEC. VI.

LAPIS MURIATICUS.

Germ. *Bitterstein.*

Its colour is mountain green, partly inclining to milk blue; it is semitransparent, has a silk lustre, is very tough, takes a fine polish.

Its specif. gr. = 3350.

Is only found in mixed rocks in Corsica, and on the Alps.

SPEC. VII.

ASBEST, from the Greek, *Asbestos, which signifies* incombustibile.

Talcum Asbestus.

This ſpecies includes the following varieties, which differ from each other in certain properties, and in appearance.

Var. I. Mountain Cork. *Suber montanum.*

Talcum aſbeſtus ſuberiformis.

French. *Liege foſſile.*

Germ. *Bergkork.*

This is a very light ſubſtance, reſembling cork; it is found of a light white, reddiſh white, yellowiſh grey, cream yellow, and yellowiſh brown colour; it is found compact; it has a fibrous texture; the fibres run in irregular directions; it is quite opaque, ſuffers impreſſions from the nail; when in thin pieces, it is ſomewhat flexible, elaſtic, has an arid appearance, generally ſo light, as to ſwim on water.

Its ſpecif. gr. = 0,993, to 1,000.

It efferveſces a little with acids, but is not ſoluble in them.

It yields by analyſis, 62 ſilic. 2,8 argill. 22 magneſ. 10 calcar. earth, and 3,2 iron.

It is found at Salberg in Sweden, and at Johann Georgenſtadt in Saxony, containing often ſilver ores, as at Clauſthal on the Harz, in Donnemore in Sweden, in Hungary, Carniola, &c.

Another

Another kind is called *Mountain Leather*; French, *Cuir fossile*; which is composed of broad flexible lamellar pieces resembling leather, and is still lighter.

Its specif. gr. = 680. It yields by analysis, 56, 2 silic 2 argill 26,1 magnesian, 12,7 calcar. earth, and 3 of iron. It is found in the *Olonezki Mountains*, on the *Oka*, in gypsum.

VAR. 2. AMIANT, *Mountain Flax.*

(Ripe Asbet.)

French. *Lin fossile.*

Germ. *Bergflachs.*

Lat. *Talcum asbestus amianthus.*

Born Catal. *Asbeste feuilletée.*

Gmel. *Asbestus amianthus.*

This substance is composed of long thin flexible fibres, or filaments, of a greenish, or silver white, yellowish or flesh, colour; it exhibits a silky lustre, sometimes resembling a metallic lustre; the fibres run sometimes parallel, sometimes curved; it is generally a little semitransparent; it is soft and rather fatty to the touch, and when rubbed it may be brought into a state resembling wool.

Its ſpecif. gr. = 908; it melts *per ſe*, which is ſeen, when a few filaments are burnt in the flame of a candle; it diſſolves in microcoſmic ſalt, becoming afterwards by continued heat, a green glaſs, which melts in earthen crucibles, but acts upon them.

It yields by analyſis, 64 ſilic. 2,7 argill. 17,2 magneſ. earth, 2,2 iron, and 13 calcar. earth: A certain kind from Savoy yields by analyſis, 64 ſilic. 3,3 argill. 18,6 magneſ. 6,9 calcar. 6 baryt, and 1,2 iron.

It is frequently found with the aſbeſtus and ſerpentine; a very fine ſort is found in Candia, Cyprus, Corſica, in Siberia, China, in Sileſia, near Zöblitz, and in the Savoy mountains. The Romans uſed to prepare this ſubſtance to make linen of it, and as it is incombuſtible, and purified by fire, they uſed it, to envelope the dead bodies which were to be burnt, in order thus to collect the aſhes, and not to loſe any thing of the remaining parts of the body.

It is now uſed for making paper, and alſo for wicks.

VAR. 3. COMMON ASBEST. *(Unripe Aſbeſt.)*

Aſbeſtus vulgaris.

Waller. *Aſbeſtus durus lignoſ. fibris parall. &c.*

Ital.

Ital. *Amiantho immaturo.*

Fr. *Asbest non mure.*

Its colour is greenish grey, yellowish leek, and olive green; it has hardly any lustre; it is composed of rigid stony fibres, which are a little flexible, sometimes curved or undulated, and exhibit generally cuneiform pieces.

It is a little smooth to the touch, partly resembling rotten wood; it is semitransparent on the edges; its surface can be scratched with a knife, sometimes it scratches glass; it is not readily acted upon by acids; it is not altered by fire, except that it becomes harder; it melts with borax and soda into a white vitreous mass.

Its specif. gr. is generally = 2500.

It is found frequently at Zöblitz in Saxony, Bareith, in Sweden, Siberia, Tyrol, &c.

It is found by analysis, to be composed of siliceous, argill. magnesian, and calcar. earth, and a little iron.

SPEC. VIII.

MOUNTAIN WOOD.

Talcum asbestus lignosus.

Germ. *Bergholz.*

Its colour resembles brown wood, sometimes inclining to yellowish; it is opaque, elastic, flexible; its texture is slaty, curved, and irregularly fibrous; it is only found at Clausen in Tyrol.

SPEC. IX.

RADIATED, or STRIATED SHOERL.

Germ. *Strahlstein, Strahlschörl.*

This substance is frequently confused and arranged with the real shörl; it is found mostly of a greenish colour, greyish, partly semitransparent, radiated, or in thin bars.

Mr. Werner mentions three varieties.

VAR. I. COMMON STRIATED STONE.

Germ. *Gemeiner Strahlstein.*

Talcum actinotus vulgaris.

Gmel. *Actinotus.*

Its colour is apple—mountain—leek-olive—and blackish-green, also reddish grey. It is found compact, in long flat 4 and 6 sided prismatic crystals, the prisms are disposed parallel, sometimes diverging, partly irregularly crossing each other; have a lustre, are brittle, not flexible.

flexible. The texture of the compact kind is radiated, stellated, and granulated.

The crystals are semitransparent, and longitudinally striated, and not greasy to the touch. A certain kind is found to have its colour from prasem, with which it is found. It is also found in feldspar, quartz, mica, steatite, serpentine, amianth, calcar. spar.

It constitutes often the matrix of certain metals, as of the iron—copper—and tin, ores.

It yields by analysis 43 silic. 22 calcar. earth, and 34 iron.

It is frequently found in Zitterthal, in Tyrol, in Swedish iron mines, in Saxony near Ehrenfriedersdorf, near Gieshübel, with copper, iron, zink, and lead ore; Hornblende and prasem, &c.

VAR. 2. VITREOUS STRIATED SHÖRL.

Germ. *Glasartiger Strahlstein.*

Talcum actinotus vitriforme.

Gmel. *Actinotus vitreus.*

It is of a silver and greenish white olive green colour; it is found in solid masses, and also crystallised, in needle-shaped, and longitudinally striated, long thin six-sided crystals, mostly ly coherent; it has a vitreous luſtre, and is ſemitranſparent.

Its ſpecific gr. = 3,452.

The compact kind has a radiated or fibrous texture; it is very brittle, and not greaſy to the touch; it is found near Allemont in Dauphiné; in Zitterthal in Tyrol; on the iſland Sky, in Scotland.

VAR. 3. ASBESTOUS STRIATED SHÖRL.

Germ. *Aſbeſtartiger Strahlſtein.*

Talcum actinotus aſbeſtus.

Its colour is mountain green, greeniſh white; its luſtre reſembles mother of pearl; its texture is radiated; it is opaque, ſoft, and is frequently found on Fichtelberg in Bareith.

SPEC. X.

TREMOLIT. TREMOLITES.

It has a ſilver white colour, a ſilky luſtre; is partly ſemitranſparent, moſtly diverging and barlyke, generally exhibiting cuneiform pieces, the particles croſſing each other, in a diverging manner; it is brittle; its texture is fibrous, when its ſurface ſcratched with a needle in the dark, it yields phoſphoreſcent ſparks.

It

It effervesces a little with acids; it scratches glass; it is found in the valley Tremola, on St. Gotthards.

It yields by analysis 100 magnesian, 650 sili. 180 calcar. earth, 69 water and carbonic acid.

SPEC. XI.

SPUMA MARIS.

Gmel. *Talcum spuma maris.*

Germ. *Meershaum.*

Fr. *Ecume de Mer.*

Its colour is white, and yellowish white; it has an arid appearance; is smooth to the touch, and soft; becomes a lustre when polished or cut; absorbs water; adheres to the tongue, and is very light; it is found in solid pieces.

It is used for tobacco pipes. The best kind is found in Kiltschik near *Koni*, in Anatolia, and North America.

It yields by analysis 54, 16 silic. 44, 66 magnesian earth.

GENUS VI.

CALCAREOUS EARTHS and STONES.

THE calcareous ſubſtances are found in the ſtate of earths, indurated, compact, and in the ſtate of ſtones; they partly originate from animal and vegetable ſubſtances, and partly from other ſubſtances, which had probably exiſted previous to animals and vegetables, and thoſe of a prior formation are called primitive limeſtones.

Calcareous earth the chief component part of the ſubſtances, belonging to this genus, on account of its great affinity to other ſubſtances, is never found quite pure. The ſubſtances ranked under this head, contain generally other mineral—vegetable—or animal, ſubſtances; water, carbonic acid, inflammable ſubſtances, oxyd of metals, or other earths and ſtones, not yet alluded to; notwithſtanding which, they retain characteriſtic properties, which diſtinguiſh them from

from the ſubſtances belonging to the other genera of earths and ſtones, and alſo from each other, laying a foundation for a diviſion of them, into ſpecies and varieties.

The limeſtone, or compact calcareous earth, which forms mountains, may admit of three diviſions.

1. That which is found in large beds, reſting on the primitive granit, and which is called primitive limeſtone, containing ſilex, ſhörl, fieldſpar, &c.

2. That which is found near primitive mountains, and which forms rocks, and contains no ſhells or cockles.

3. That which contains ſhells or cockles, and madrepors, &c.

The calcareous ſtones are never found ſo hard, as to ſtrike fire with ſteel, or ſcratch glaſs; they can all be ſcratched or ſcraped with a knife; and ſome are quite friable, and ſtain the fingers.

Calcareous earth has in various ſtates of purity and admixture, been wiſely ſcattered over every part of the habitable globe; and is found uſeful to many purpoſes in common life.

The calcareous ſubſtances that have not undergone an intimate combination, or that have

not

not been altered by union with other ſubſtances, have a dry earthy appearance.

Thoſe of a harder nature, exhibit when broken, an even, granular, ſeldom a radiated texture, or they have a ſparry appearance, which approaches them to a cubical form, and have a luſtre.

Of this kind ſome are tranſparent in different degrees, others are cryſtalliſed, or exhibit a regular ſhape.

All of them can be eaſily reduced to powder.

The ſofter and looſe kinds abſorb water, and have beſides, a great affinity to carbonic acid, or fixed air, which cauſes them to efferveſce with other acids.

Aerated calcareous ſtones, when expoſed to a ſtrong heat, are deprived of the carbonic acid, and loſe the property of efferveſcing. They combine, or are ſaturated with heat, and ſo become ſoluble in water. During their ſolution in water, they part with a great quantity of abſorbed heat, and thus again recover their affinity to carbonic acid, and their power of depriving other ſubſtances of it.

When pure or ſaturated with heat, they diſengage ammonia, or volatile alkali, from ſal ammoniacum, or muriate of ammonia.

They

They never melt per ſe, in the fire, nor do they harden in it.

They are ſoluble in nitric and muriatic acids, and form with them ſalts, which deliqueſce, when expoſed to the atmoſphere. For the other chemical diſtinguiſhing properties of the calcareous earth, vide page 42. The different ſubſtances by which the ſtate, appearance, and nature of calcareous earths is altered, are as follows.

1. The carbonic acid.
2. The boracic acid.
3. The ſulphuric acid.
4. The fluoric acid.
5. The phoſphoric acid.
6. Petroleum, or bitumen.

Many are mixed, or combined with other earths, and oxyd of metals, in different proportions, according to which, the following diviſions have been made.

DIVISION I.

Calcareous ſubſtances containing carbonic acid.

The ſpecies belonging to this diviſion, are ſoluble with efferveſcence, in nitric and muriatic acid; when expoſed to a ſtrong heat, they unite with a certain quantity of heat, which they give out again, when mixed with water, in which they

they are now ſoluble, and precipitate the ſolution of corroſive ſublimate of an orange yellow colour.

When cryſtalliſed, their regular figure is ſuppoſed by certain mineralogiſts, to be derived from the parallelopiped; others ſuppoſe it to be priſmatic.

They are not hard; they form ſelenite with ſulphuric acid.

SPEC. I.

CHALK.

Lat. *Creta.*

Gmel. *Creta ſcriptoria.*

Waller. *Creta coherens ſolida.*

Cronſt. *Creta ſolida friabilis.*

French. *Craje blanche.*

Germ. *Kreide.*

This is a ſtony ſubſtance, generally compact, ſeldom found in powder; it is white, or yellowiſh white, and opaque; may be marked or impreſſed by the nail; is uſed for marking or writing; it abſorbs water, but dries ſoon after, and is therefore uſed by chymiſts for filtering, or for ſeparating the moiſture of fine precipitates. It is found in ſolid maſſes of an earthy appearance, without any luſtre; adheres to the tongue,

tongue, feels rather rough between the fingers; efferveſces ſtrongly with acids.

It contains generally 40 per cent. carbonic acid; it is found containing flints, and other ſubſtances, in large ſtrata, particularly on certain ſea coaſts as in England, Sweden, Germany, and other parts of the world.

SPEC: II.

LIME-STONE.

Lat. *Lapis calcareus.*

This ſpecies differs from the foregoing, by higher degree of hardneſs, and by its containing various heterogeneous ſubſtances.

Var 1. Compact Lime-stone.

Fr. *Pierre a chaux compacte.*
Germ. *Dichter Kalchſtein.*
Hung. *Meſzkö.*
Swed. *Fät Kalkſtein.*

a. Common Lime-stone.

Its colour is greyiſh or yellowiſh, blueiſh grey, ſmoke-grey, ſeldom of fleſh colour, cream yellow and blackiſh, often exhibiting various

various colours mixed; it has a dull appearance; the harder kind takes a poliſh, and is called marble.

It forms large chains of rocks, gangues, moſt generally ſtratified, or flötz mountains, and contains animal petrefactions.

It originates from a precipitation of the ſea water.

b, Oolithus.

Germ. *Rogenſtein.*

Lat. *Calcareus marmor oolithus.*

Fr. *Oolithe, Pierre ovaire.*

Hung. *Tojás—Kö.*

This ſtone is compoſed of a number of grains of compact lime-ſtone, cemented by a clayiſh ſubſtance, is generally of a dark yellowiſh grey and brown colour, generally both colours are met with in one ſpecimen, ſo that the grains are brown, and the other intermixed maſs, or the cement is grey; the grains are found from the ſize of a pea, down to the ſize of a muſtard ſeed.

It is found forming whole flötz mountains, near Eiſleben, Thüringia, &c.

Some authors ſuppoſe it to be petrified fiſh eggs.

It

It generally contains 90 parts calcareous, 10 argillaceous earth, and 1 iron.

VAR 2. LAMELLATED LIME-STONE.

Germ. *Kalkſchiefer, blättricher Kalchſtein.*
Calcareus marmor lamelloſum.

a. *Of a granular texture.*

Granular Lime-ſtone.

Its colour is light, yellowiſh, greeniſh, greyiſh, white, ſeldom yellow, blueiſh, grey, and black.

It is found in compact maſſes; when broken, is a little ſhining, and has a lamellar grained texture.

It exhibits ſometimes dentrical figures, and impreſſions of marine animals of the later creation.

It is found near primitive mountains, in layers of gneiſs, micaceous, and argillaceous ſhiſtus.

SPEC. III.

TOFUS.

Germ. *Kalkſinter.*

Swed. *Sinter.*

This ſtone has been depoſited from lime water in the cavities of the lime flötz mountains, and in ſeveral hot wells. It is found of various colour, of different degrees of hardneſs, and of a fine texture. The texture is found radiated or fibrous, ſpatous and compact, according to its different appearances, or ſhapes, it may be brought under certain diviſions.

VAR. I. STALACTITICAL LIME-STONE.

Calcareus Stalactites.

Germ: *Tropfſtein.*

This kind is found in the cavities of mountains, of a ſtalactitical, or other particular ſhape.

This ſtone has been formed by the gradual depoſition and evaporation of water, impregnated with lime, which has been more or leſs inſpiſſated or hardened by the air; and according to certain circumſtances, it exhibits ſtalactitical

titical figures, ſuch as the, improperly called, *flores ferri*; which, when tranſverſally broken, has a ſtellated texture.

The *Baumanſhöhle* on Harz, is remarkable for ſuch products, where ſtalactites of this kind are found of 10 inches in diameter, and ſometimes of a tubular form. This kind is ſometimes a little ſemitranſparent, and glittering, according to the different quantity of water and carbonic acid which it contains. Sometimes the maſs runs into cavities, and fills them, and becomes on drying more or leſs compact. This kind is uſed by ſtatuaries for various purpoſes.

It is ſometimes found coating roots of trees, which in time moulder away; they are called oſteocolla. Sometimes it enwraps or involves different parts of plants or parts of animals.

To the incruſtating kinds belong the globular incruſtations, as the *Oalites* and *Piſolithes*, which are formed in the Carlſbad, containing ſand corns, incloſed; and the ſo called *ſprudel ſtone*, or *ſputtering ſtone*, from Carlſbad, which exhibits various colours and figures.

At Gibraltar it is found filling up certain cavities containing bones, and cementing the oſteolithe, &c. with this kind may be ranked the *alabaſtre antico*, and *confetto di Tivoli*, reſembling ſometimes candied ſugar figures.

SPEC. IV.

CALCAREOUS SPAR.

Cronſt. *Spathum calcareum et druſicum.*

Fr. *Spath calcaire.*

Germ. *Kalch ſpath.*

This ſpecies of calcareous ſtone, united to carbonic acid, differ from the foregoing ſpecies and varieties. It is purer than the other; it is found of different degrees of tranſparency; it has a lamellar texture, and breaks in parallel rhomboidal plates; its ſurface is more or leſs ſhining; and is beſides found cryſtalliſed, or of regular ſhape.

It is found of various colours.

When expoſed to heat, it parts with its tranſparency, and carbonic acid. It is generally compoſed of 55 parts of calcar. earth, 34 carbonic acid, and 11 of water; and its ſpecif. gr. = 2715. It is found in ſtratified or flötz mountains.

The following varieties are diſtinguiſhed, reſpecting their colour.

White,

White, found on the Harz, and various other places.

Greyiſh black, at Schneeberg, near Freiberg, &c.

Amber colour, in Bohemia, at Ratiborſchiz, Idria, &c.

Greeniſh, near Freiberg, and upper Lauſatia.

Olive green, near Schemnitz, in lower Hungary.

Purple, at Andreaſberg.

Yellow, on Harz, in Kärnthen, Derbyſhire, and Eaſt India.

Honey colour, at Zellerfeld on Harz.

Fleſh colour, at Adelfors in Sweden.

Roſe colour, at Andreaſberg.

The following varieties or modifications are known, with reſpect to figure.

Pyramidical.

Simple Pyramids.

1. *Perfect.*

a. Six ſided pyramids, with equal angles and ſides, viz. the dog tooth ſpar.

b. ——— two and two faces meeting under an obtuſe angle.

 Double

Double Pyramids.

c. The ſide faces of the one obliquely placed upon the other.

d. Three and three ſide faces meeting under an obtuſe angle.

e. The cryſtals of *a* and *b* adhering.

2. *The angles of the baſis truncated.*

a. The ſix ſided ſimple pyramid with the angles of the baſis truncated.

b. The double ſix ſided pyramid, and the ſide faces of the one proceeding from the ſide faces of the other.

3. *The ends accuminated by three faces.*

a. The ſimple two ſided pyramid accuminated by three convex faces.

b. The double ſix ſided pyramid, the ſide faces of the one proceeding from thoſe of the other, having the angles of their common baſis truncated.

4. *Simple pyramids in an inverted poſition.*

a. Six ſided pyramid, the end face accuminated by three faces, which proceed from the alternate ſide faces.

b. The ſix ſided pyramid, with a druſic end face.

5. *Of ſix ſided priſmatic figure.*

a. The

a. The ſix ſided priſm accuminated on both ends by ſix faces; the ſide faces of which proceeding from the ſide edges of the priſm. The faces of the accumination exhibit rhomboid faces, end the ſide faces longiſh hexagons.

b. The ſame; but each pyramid terminated again by three faces; the faces of which proceed from the alternate ſide edges of the firſt pyramid; in ſhort, doubly accuminated on both ends.

c. The ſix ſided priſm obtuſely accuminated on both ends, by three faces, proceeding from the alternate ſide faces of the priſm, and the ſides of the other accumination, proceed from the ſide faces of the priſm, which were left free from the accumination of the other end; all the faces of theſe cryſtals exhibit pentagons.

d. The ſix ſided priſm accuminated by three faces like the foregoing, but truncated.

e. The perfect ſix ſided priſm.

f. The perfect ſix ſided plate.

6. *Of three ſided pyramidical figure.*

a. The lenticular.

b. The ſaddle ſhaped lenticular.

c. The three ſided pyramid, flat, double, and the angles of the baſis truncated.

d. The perfect three ſided pyramid, flat and double.

e. The rhomb, or the rhomboidal octoedron.

f. The cubical.

g. The acute, angular, three ſided double pyramid.

h. The ſame, but hollow.

i. The acute, angular, three ſided pyramid, hollow.

To the rhomboidal kind belongs the double ſpar from Iceland, Fr. *Spath d'Iſlande*, Germ. *Doppel Spath*.

This kind repreſents objects double, ſometimes triple; when looked through, we find it to be owing to the lamellated texture.

Its acute angle deſcribes about 77 degrees, and the obtuſe, 112.

SPEC. V.

BROWN SPAR.

Germ. *Brown Spath*.

Calcareus Spathum Cruneſcens.

Its colour is generally milk white, fleſh, and roſe colour, greyiſh, yellowiſh, and reddiſh

diſh white; when expoſed for ſome time to air, it becomes browniſh; it is generally opaque, ſeldom tranſparent; its texture is lamellated, reſembling heavy ſpar, or ſpatous ironſtone; it is a little harder than calcar. ſpar; it only effervеſces with nitric acid when reduced to powder; it is found ſolid, very ſeldom kidney ſhaped; but frequently cryſtalliſed, viz. 1. Lenticular. 2. Rhomboid. And in hollow, acute—angular—ſix ſided pyramids.

It yields by analyſis, 50 parts calcar. 22 iron, 28 manganeſe. The greateſt quantity is found near Freiberg, Schneeberg, and Annaberg.

SPEC. VI.

PLATED SPAR.

Germ. *Schieferſpath.*

Fr. *Spath Shiſteux.*

Swed. *Skifwer Spath.*

It is found of a greyiſh, and reddiſh white colour, has a luſtre, ſimilar to mother of pearls; is a little ſemitranſparent, has a curved lamellated texture, is ſoft, effervеſces ſtrongly with nitric acid; it is found ſolid, and coarſely interſperſed,

terſperſed, is brittle; it is found particularly near Schwarzenberg in Erzgebürge.

SPEC. VII.

PEARL SPAR.

French. *Spath perlé.*

Germ. *Perl ſpath.*

This ſubſtance is white, yellowiſh and reddiſh, ſemitranſparent, and has a pearl luſtre.

It yields by analyſis, 60 aerated calcareous earth, or carbonate of lime, 35 magneſian earth, and 0,3 of iron.

It is a little harder than the common calcareous ſpar.

Its ſpecif. gr. = 28,37.

It is found cryſtailiſed in rhombs, the acute angle of the faces deſcribe 77 or 78, and the obtuſe 102 or 103.

It reſembles the double ſpar.

It is found in the mines of St. Marie, in Bavaria, and on the Harz.

SPEC. VIII.

STELLATED SPAR.

Germ. *Sternſpath.*

Mr. Fitchal found it in the limeſtone of the Carpathian mountains.

It

It effervefces with acids.

According to Bindheim, it yields by analyfis, 66 calcar. 30 filic. earth, and 0,3 iron.

SPEC. IX.

MARL.

Germ. *Mergel.*

Lat. *Calcareus marga.*

French. *Marne.*

This fpecies includes thofe kind of aerated calcareous fubftances, which are mixed with a confiderable portion of clay, fand, mica, fometimes magnefia, or of feveral of thefe together; fome kinds are alfo penetrated with bitumen; it feems to originate from the depofition of river and fea water; it is not fo compact as the marble, and does not take a polifh; it has its colour generally from iron; it effervefces with nitric acid, and is, for the greateft part, foluble in it.

It is found in the beds of rivers, on hills, and in flat countries fubject to inundation.

Marl yields feveral varieties, according to its different ftate and compofition.

VAR. 1. EARTHY MARL, LOOSE MARL:

Lat. *Calcareous marga friabilis.*
French. *Marne terreuſe.*
Swed. *Mergel—Lera.*
Hun. *Tſapo—Föld.*

Its colour is yellowiſh white, or yellowiſh grey; it has an arid appearance, is earthy to the touch and ſoft; effervesces with acids, ſoftens in water, and forms a paſte, not adheſive when expoſed to heat; it is found in certain calcareous flötz-mountains, viz. in the principality of Mansfeld and Sangerſhauſen, is chiefly compoſed of lime and clay; it is employed to improve the ſoil.

VAR. 2. MERGEL TUFF.

This ſubſtance is found frequently in the flat alluvial mountains, generally exhibiting traces of vegetables, which had formerly been incruſtated, particularly impreſſions of leaves and roots, &c. ſometimes repreſents the ſmaller kind of water ſnails; it is remarkable, as it forms frequently the matrix, or the beds in which the foſſils of elephants, rhinoceros, turtle, and other India animals, which are now found frequently in Germany.

VAR.

Var. 3. Indurated and compact Marl.

Germ. *Verhärteter Mergel, or Mergel-ſtein.*

French. *Marne pierreuſe.*

Lat. *Calcareus marga indurata.*

Its colour is generally grey; it has a dull appearance; its texture is compact, earthy, and ſometimes ſhivery; it is opaque; ſome kind take a little poliſh; certain kinds are called in Germany *Zechſtein*; other kinds bear various provincial names, according to the various purpoſes to which they are employed. It is found only in flötz-mountains.

With the indurated marl, may alſo be ranked, the ſtones called *ingwerſtein,* alſo the aetites or the eagle-ſtone; alſo that remarkable ſtone called *ludus helmontii,* or waxenſtein, which is only found in a few places, viz. near Anſwers, and in Franconia.

Var. 4. Marl Shistus.

This kind of ſtone contains very fine dentritical vegetations, which is found at Iberg, on the Harz. To this belongs alſo the *ruin-marble,* pæſino,

pæſino, and cittadino, from Florence. A ſimilar beautiful kind is found in Tyrol.

DIVISION II.

This includes ſuch calcareous ſtones, as conſiſt of the ſame component parts as the marl, but which are mixed with bituminous ſubſtances.

SPEC. X.

BITUMINOUS MARL SHISTUS, alſo improperly called *Slaty Copper Ore.*

Germ. *Bituminöſer Mergel Schieſer.*

Lat. *Calcareus ardeſia margatia.*

Gmel. *Marga Bituminoſa.*

Waller. *Cuprum corroſum vel diverſi mode mineraliſatum, ſhiſto inherens.*

French. *Ardoiſe ouivreuſe.*

Swed. *Koppar Schifwer.*

Hung. *Tàblàs, Rètes, Rèz.*

Its colour is greyiſh black, blueiſh, and browniſh black; has a fatty glittering appearance; has a ſlaty texture, efferveſces a little with acids, is ſonorous, when in thin plates, and is is opaque; it is earthy to the touch, and more or leſs penetrated with bitumen; contains ſometimes ores, particularly copper ore; alſo often impreſſions of organized bodies of the later creation; it forms the flötz-mountains throughout Thuringia and Mansfeld, reſting upon ſand-ſtone, which conſtitute the lower part of the lime flötz; it contains the vitrious and variegated copper ore, but moſt generally copper pyrites. It contains ſometimes three or four pounds of copper in a hundred; its moſt characteriſtical mark is, that it frequently contains impreſſions of fiſhes and ſea plants.

SPEC. XI.

SWINE-STONE.

Germ. *Stinckſtein.*

Lat. *Calcareus ſuillus.*

Cronſt. *Terra calcarèa Phlogiſto miſta, &c.*

French. *Pierre puante.*

Swed. *Orſten.*

Its colour is generally yellowiſh brown, black, cream yellow, and yellowiſh grey, has partly

partly a dull, partly a glittering appearance; when broken, it exhibits a ſhivery or conchoidal ſurface, is opaque and compact; its ſurface can be ſcraped with a knife, during which it emits a urinous ſmell; it is found in flötz mountains in various ſhapes, ſometimes ſparry, or in the ſtate of marble; contains often remains of animal parts; it is compoſed of calcareous earth and petroleum.

DIVISION III.

Calcareous earth united to phoſphoric acid.

SPEC. XII.

APATITE, APATITES.

Calcareus Apatites.

This ſubſtance was firſt diſcovered by Werner. It has its name from the Greek language, in which *appatao* ſignifies *deceive*, becauſe this ſtone was for a long time miſtaken for another, from its appearance; its colour is various, viz. mountain—aſparagus—leak green, inclining to olive green, blueiſh, yellowiſh, and chocolate brown; this ſtone has hitherto only been found cryſtalliſed, viz. in three

three and ſix ſided priſms, in ſix and eight ſided plates, variouſly modified. The priſms are found of various ſizes, ſometimes above an inch long, and near an inch in diameter. Theſe figures ſeem to derive from the parallelopiped It is ſhining, and rather of a greaſy luſtre; has a lamellated texture, is ſemitranſparent, and its ſurface can only be ſcratched with a knife.

Its ſpecif. gr. = 3,218.

It does not melt by the blow-pipe, but loſes its colour; it is but gradually diſſolved in nitric acid.

It yields by analyſis 55, calcar. 45 phoſphoric acid. It is found near Ehrenfriederſdorf, generally accompanied with quartz and fluor, lythomarge, ſmectis, arſenical—pyrites, wolfram, ſeldom molybdena and topaz.

SPEC. XII.

PHOSPHORATED LIME-STONE.

Its colour is yellowiſh white, or opaque; when broken, its ſurface appears earthy; it is heavy, and not very hard; when ſcratched with a knife in the dark, it becomes phoſphoreſcent; and when put upon red hot charcoal, it emits a green phoſphoreſcent light like the apatite; it is found in Eſtremadura, with alternate ſtrata of ſolid quartz.

DIVISION IV.

Calcareous earth united with Boracic acid.

SPEC. XIII.

BORACIT.

Calcareous Boracites.

This remarkable mineral is reſtricted to the Hanoverian territories, where it is found in a lime rock, or gyps flötz near Luneburg; its colour is generally greyiſh white, more or leſs ſemitranſparent, has moſtly a vitreous appearance; it has only been found cryſtalliſed, in cubes, with truncated edges and angles, ſo that the faces of the truncated angles, exhibit alternately, hexagons and triangles.

The cryſtal exhibiting 26 faces.

Its ſpecif. gr. = equal to 2,566.

It yields by analyſis according to Weſtrumb, 68 boracic acid, 11 calcar. 13,5 magneſian, 2 ſilic. 1 argill. earth, and 0,7 iron.

DIVISION V.

Calcareous earth united to fluoric acid.

SPEC.

SPEC. XIV.

FLUORS.

Germ. *Fluſs ſpathe.*

The fluor contains occaſionally muriatic acid, ſilex, argillaceous earth, and inflammable matter. It does not effervefce with acids; its ſurface can only be ſcratched with a knife, and is a little greaſy; it generally crackles and phoſphoreſces, when expoſed to heat, except the colourleſs ones, which become electric when rubbed, and the coloured kind loſe their colour in fire, but when expoſed to a ſtrong heat, it melts *per ſe*, and its fuſibility is increaſed by the addition of a little calcar.—or argill.—earth, but it does not combine nor melt with ſilex. It melts with borax without effervefcence; it is very ſeldom found in the ſtate of earth, moſt generally compact or cryſtalliſed in cubes; it is often accompanied with calcareous ſpar; it is generally more or leſs tranſparent, and exhibits various colours; it is harder than calcareous and heavy ſpar, it is lighter than the latter, and heavier than the firſt, and much heavier than the ſelenite; it never ſtrikes fire with ſteel.—The ſulphuric acid expels, by the aſſiſtance of heat, the fluoric acid, which has the peculiar property of diſſolving glaſs.

Its ſpecif. gr. is generally = 3,144, ſometimes a little more.

On account of its being of a fuſible nature, and its ſparry appearance, it has obtained that name.

The fluor is found in ganges of ores; it never forms whole ſtrata or beds, but generally veins or cryſtalliſed groups.

VAR. 1. FLUOR EARTH.

Lat. *Fluor Terreus.*
Germ. *Fluſs Erde.*

Its colour is generally greeniſh and greyiſh white. It has ſometimes the conſiſtency of chalk; when expoſed to a gentle heat, it exhibits a greeniſh phoſphoreſcent light; ſome kinds exhibit various colours. It is found in the diſtricts Marmoros in Hungary, and in Andaluſia, between two beds of quartz, and in the neighbourhood of Iron-ſtone.

It contains calcar. earth, fluoric, and phoſphoric acid.

VAR. 2. SOLID OR COMPACT FLUOR.

Germ. *Dichter or Derber Fluſs.*
French. *Fluor ſolide.*

Lat.

Latin. *Fluor densus calcareous.*

Ital. *Vetro fluore.*

Its colour is generally verdigreaſe, greyiſh white, and purple; it is ſemitranſparent, and has an even and glittering texture; is only found without particular ſhape, near Stollberg, and Stroſberg on Harz and in England, particularly the purple coloured.

VAR. 3. SPARRY FLUOR.

Lat. *Fluor calcareus ſpatoſus.*

Germ. *Fluſſpath.*

French. *Spath fuſible.*

Waller. *Fluor mineralis cryſtalliſatus.*

This kind is diſtinguiſhed from the foregoing varieties, by its exhibiting always a regular ſhape. It is found colourleſs; of a light and greeniſh white, ſmoke grey, purple ſky-blue, aſparagus—leek—and olive green colour; it is alſo found of a fine amber,—ſeldom of a crimſon red, colour; its principal figure is that of a cube, ſometimes truncated on the angles or edges, very ſeldom octoedrical or priſmatic; it is more or leſs tranſparent, and takes a fine poliſh; its ſurface is ſmooth; its texture curved; it breaks in three, or four ſided pyrami-

 dical

dical fragments; it contains generally 75 calcar. earth, 16 fluoric acid, and 27 water. Very fine ſpecimens of it are found in Derbyſhire, and frequently in Saxony near Freiberg, and in various other places.

The common kind of fluor is uſed in glaſs manufactories, and as a flux for certain ores or ſtones. The finer kind, which takes a fine poliſh, is manufactured into various ſtatues, figures, and veſſels.

DIVISION VI.

Calcareous earth united to ſulphuric acid.

SPEC. XIV.

SELENITE, or GYPSUM.

Lat. *Selenites.*
Germ. *Gyps.*
Ital. *Geſſo.*
French. *Gipſe.*

Sulphate of Lime.

This mineral which is compoſed of calcareous earth, water, and ſulphuric, or vitriolic, acid, is found in moſt parts of the earth, and in moſt waters.

It reſembles ſomewhat the calcareous ſpar, in appearance; it is found in ſolid maſſes, of particular

particular form, and frequently of a regular ſhape, or cryſtalliſed, has a lamellated, and ſometimes, a fibrous texture; it is only ſoluble in 500 parts of water; it is opaque, and ſemi-tranſparent; it does not efferveſce with acids, but is rendered ſoluble in nitric acid, by heat. When expoſed to heat, it crackles and loſes its water, becomes opaque, and very brittle, and when afterwards mixed with water, becomes hot, but not ſo much ſo, as the common calcareous ſtones. After being burnt, it abſorbs water, and makes good mortar.

It is leſs hard than the marbles, and takes no poliſh. Its ſpecific gravity differs, but is generally found = 1870 a 2320.

By means of the blow pipe, it diſſolves with ebulition, in borax, and ſal microcoſmicum.

It phoſphoreſces a little when expoſed to heat.

It is not altered by air; is ſoft to the touch, and is found of various colours, white, reddiſh, yellow and browniſh.

Its primitive figure ſeems to be the rhomboidal dodecaedron, or the rhomboidal octaedron, with the two points of the pyramids truncated: Or otherwiſe deſcribed; it exhibits two ſhort four ſided pyramids, having the baſis rhomboidal, with the angles of 52° and 128°.

It ſeems to originate from the ſulphuric acid vapour having combined with the calcareous earth, in various parts of the earth; or the calcareous earth has been ſeparated from its other combinations, by the ſulphuric acid, to which it has a ſtronger affinity than to moſt other mineral products.

VAR. I. GYPSEOUS EARTH. FARINA FOSSILIS.

Germ. *Gyps erde*, or *Gyps mehl.*
Cronſt. *Terra gypſea pulverulenta.*

This is a white, friable, looſe, powdery, ſubſtance, which originates from cryſtalliſed ſelenite. It feels ſandy between the teeth, effervesces a little with nitric acid; becomes very white when expoſed to heat. It is very light.

It is found in the clifts or fiſſures of gypſum rocks. It is ſaid to be an excellent ſubſtance for promoting the growth of certain plants, when mixed with the earth in which thoſe plants are deſigned to grow.

VAR. 2. ALABASTER.

Germ. *Dichter gyps.*
Fr. *Alabâtre.*
Calcareus gypſum ſolidum.

This

This ſtone bears ſome reſemblance to marble, and exhibits various colours; is ſometimes ſpotted; ſometimes interſected with veins, or variegated with colours; it does not effervesce with acids; it is ſofter than marble, and does not therefore take a good poliſh; it can be cut with a knife; its texture is ſhivery and glittering; it is found of a yellow, greeniſh, reddiſh white, and blackiſh colour. Its ſpecif. gr. is = 1872. It is compoſed of 32 parts of calcareous earth, 30 of ſulphuric acid, and 38 water.

It is found ſolid in flötz mountains; in Ruſſia, Spain, Tuſcany, Sicily, and in various other places.

Var. 3. Lamellated Gypsum.

Germ. *Blàttriger Gyps.*

Fr. *Gyps feuilleté.*

Lat. *Calcareus gypſum lamelloſum.*

Wall. *Gypſum lamellare, &c.*

Its colour is yellowiſh grey, blackiſh honey colour, and fleſh colour. It is found ſolid and interſperſed, and in lenticular cryſtals; it is ſtrong, ſhining, has a curved lamellated texture; is friable like looſe ſand-ſtone; ſometimes

times it is mixed with quartz, when it ſtrikes fire with ſteel.

It is found in flötz mountains. It conſtitutes the matrix of various ſtones, as well as of the boracit. It contains occaſionally calcareous ſpar, as in Arragonia, in Gallicia, the ſo called hyacinths of Compoſtella, and alſo quartz cryſtalls. It never contains petrefactions; when penetrated with bitumen, it is called *liver-ſtone.*

VAR. 4. FIBROUS GYPSUM.

Germ. *Faſriger Gyps.*

Calcareus Gypſum fibroſum.

Fr. *Gypſe-ſtrié.*

Swed. *Strälgips.*

Lapis inolithus ſtirium. Strahlgyps of Blumenbach.

It is found yellowiſh, greyiſh, reddiſh, and of honey colour; it is found in ſolid maſſes, little ſhining; its texture is fibrous, filamentous, and radiated; it is generally a little ſemitranſparent; it is generally accompanied by the other gypſum, and is found frequently near Dürreberg, near Merſeberg, and in Jena, in great quantities.

SPEC.

SPEC. II.

SELENITIC-SPAR.

Germ. *Fraueneis.*

Calcareus ſelenites.

Fr. *Selenite.*

Ital. *Scagliola.*

This mineral is found colourleſs, yellow, ſmoak grey, and brown.

It is generally found ſolid, and ſometimes cryſtalliſed in ſix ſided pyramids; in four, ſix, and eight ſided priſms, and alſo lenticular, and in rhomboidal plates; it breaks in rhomboidal pieces, is ſhining, ſemitranſparent, in different degrees; is ſoft and a little flexible, ſometimes exhibits a metallic luſtre.

It contains the pureſt gypſum earth. It is found with copper pyrites, grey copper ores, and Galena in Bohemia, &c.

It is uſed for paſtell-colour, and for cleaning ſilver veſſels.

It forms flötz mountains; but is ſeldom found in ganges.

ADDI-

ADDITION to the CALCAREOUS STONES.

MARBLES.

The ſtones which are comprehended under the above denomination, are of a calcareous nature, and effervefce with nitric and muriatic acid; they are ſomewhat harder than lime-ſtones, more compact, of a cloſer grain, and are ſuſceptible of a good poliſh. The ſpecif. gravity of theſe ſtones, is generally from 2,7 to 2,8; their texture, like that of lime-ſtones, is either lamellar or granular, and their colours various, not only in different maſſes, but in the ſame pieces. When the different ſpecies of which they are compoſed, are in large diſtinct maſſes, they are called *Breccias*; marbles of three colours, grey, yellow, and black, which abound in petrefactions, are called lumachellæ; moſt of the marbles are denominated according to their appearance. The white marble of Carara is the pureſt we are acquainted with; it has a granular texture, and like ſugar, exhibits a glittering fracture, when juſt broken.

There are black, grey, blue and green marbles, which ſeem to be of the ſame nature, and contain a very ſmall proportion of extraneous

ous ſubſtances, leſs than any of the other kinds of marble.

Varieties of marbles ſtones.

White greyiſh marble. *Bardillio di Carrara.*

Reddiſh marble. *Roſſo di Montieri.*

Fleſh coloured marble. *Roſſo di Caldona.*

Red marble, inclining towards yellow.
Roſſo di Sorbi.

Red marble, inclining towards yellow.
Roſſato di piſtoja.

Red marble, inclining towards brown.
Roſſo di Viterbi.

Brown red marble. *Roſſo di Conti.*

Yellow red marble, with deep red zones.
Lineato della Sieci.

Grey bluiſh marble. *Bardillio di Carrara.*

Yellow greeniſh marble.
Verde giallo della Quereiola.

Yellow greyiſh marble. *Biggio di Rovezano.*

Yellow brown marble. *Giallo di Borſelli.*

Yellow

Yellow marble, lighter. *Giallo della Cecina.*

Marble of a yellow greyiſh colour. *Grigiato di Pratolino.*

Greeniſh marble. *Verde del Onbrone.*

Light grey marble. *Biggio di Poppi.*

Deep grey marble. *Biggio di Ortaccio.*

Reddiſh grey marble. *Biggio di Conpioppi.*

Deep black marble. *Paraone di Fiandra.*

Lighter black marble. *Nero di Piſtoja.*

Various coloured marbles.

White marble, ſpotted with pale red, and black points. *Pochanaja di Carrara.*

White marble, ſpotted with brown veins. *Breccia d'Egitto.*

White yellowiſh marble, ſpotted with red. *Breccia della Colonine.*

White marble, ſpotted with grey. *Bianco di Carrara.*

White

White yellowiſh marble, ſpotted with little grey points. *Caſtra cane della Caſtellina.*

Red and white marble. *Roſſo di Francia.*

Red, brown, and white marble.
Breccia di Maremma.

Red, white, and yellow marble.
Breccia della Rufina.

White and black marble.
Nero e Bianco antico.

Grey and yellow marble. *Gigiato di Siena.*

Marble ſpotted with white and pale red.
Roſato di Maremma.

Yellow, white, and red marble.
Brocatello di Maremma.

Red and white marble, with ſemitranſparent, ſpatous ſpots. *Lumachella di Serravilla.*

Grey, yellow, and brown marble.
Miſtio di Moſſumano.

Grey marble, with whitiſh ſpots.
Breccia di Vicentino.

Yellow marble, ſpotted with white, with blackiſh points. *Perato della Graſſina.*

Blueiſh and white marble.
Cipolino di Falgano.

White

White marble, ſpotted with green.
Verde di Monte Rufoli.

White marble, with deep red, or purpled ſpots. *Diaſpro di Bargea.*

Marble, ſpotted with green and brown.
Verde del Mulinaccio.

Marble with red ſpots, cinnabar colour, deep red and white. *Breccia di Pietra Santa.*

Marble ſpotted with light red, white, and black. *Roſato di Volterra.*

Marble with red, white, yellow, and black ſpots. *Breccia di Maſſumano.*

Purpled red marble, yellow and white.
Brocatello di Spayna.

Marble with purple coloured or grey ſpots.
Perſichino di Seraveza.

Red and brown marble.
Roſſo di Monte Catini.

Marble ſpotted with light red, brown and white. *Roſſo di Rimandrio.*

White, grey, and red marble.
Roſſo di Monte Quercioli.

Red,

Red, brown, and yellow marble.

Paonazo di Sales.

Red, white, brown, and yellow marble.

Pinochiato antico.

Red, grey, white, and black marble.

Porta Santa di Campillia.

Deep red, grey, and white marble.

Mistio di Serravalle.

Yellow, grey, and black marble.

Giallo e Nero di Siena.

White, transparent, red, and grey marble.

Mistio di Modena.

White, cinnabar red, and black marble.

Africano Rosato Antico.

Yellow, white, and grey marble.

Mistio di Seraveza.

Yellow marble, spotted with black.

Tigrato di Munione.

Yellow, white, red, and grey marble.

Diaspro di Sicilia.

Yellow, grey, and white marble.

Breccia di Pisa.

Yellow, brown, and white marble.

Giallo Antico.

Brown and white marble. *Perato di Sicilia.*

Grey and brown marble. *Perato di Munione.*

S Yellow

Yellow and brown marble, with ſpots of tranſparent calcareous ſpath. *Giallo di Spagna.*

Red, brown, black, and white marble.
Roſſo di Trapani.

Grey, red, black, and white marble.
Minerale di Caſtillione.

Green and red marble.
Perſichino della Graſſina.

Red, black, and yellow marble, with ſemi-tranſparent ſpots. *Alabaſtro pecorello.*

Black, brown, and white marble.
Breccia de Margueritta.

Black, red, and white marble.
Granito d'Africano.

Marble with large black, white, and brown ſpots. *Porta Santa di Roma.*

Black, yellow, and grey marble.
Nero polveroſo.

Black, white, and yellow marble.
Nero e Bianco di Porto Ferrajo.

Black, red, white, and grey marble.
Diaſpro di Valombroſa.

Marble with white and black ſtripes.
Bardillio di Seraveza.

Black,

Black, grey, and white marble.
Nero e Bianco di Verona.
Black and white marble, with red veins.
Nero di Ancona.
Black, grey, and yellow marble.
Nero e giallo di Porto Venere.
Black, green, and white marble.
Verde di Germania.
Black, green, and white marble.
Breccia di Siena.
Figured marbles.

GENUS VII.

BARYTIC GENUS.

THIS Genus includes ſuch ſtones as are principally compoſed of baryt or ponderous earth.

The baſis of theſe ſtones, (the barytic earth) is never found in a ſeparate or pure ſtate ; it is found united with carbonic acid, (or fixed air) or with ſulphuric acid, or is mixed to other earths and ſtones.

This earth has a ſtronger affinity to ſulphuric acid, than any other earth, and can therefore decompoſe the combinations of other earths, with that acid. It can be ſeparated from the carbonic acid by heat, or by diſſolving it in nitric or muriatic acid, and then precipitating the baryt from the acid it is united with, by potaſh or ſoda.

When united to ſulphuric acid, a decompoſition may be produced by potaſh, if heat be applied.

The

The chemical diſtinguiſhing properties of this earth, are recited in the firſt part of the work.

The ſtones of this genus, are generally of a hard nature; they can however be ſcratched with a hard knife, but never ſtrike fire with ſteel.

The barytic ſtones crackle when expoſed to heat, and phoſphoreſce a little. They are alſo diſtinguiſhed by their gravity, in which they exceed all other ſtones.

The following ſpecies and varieties are known.

DIVISION I.

Baryt united with carbonic acid, or fixed air.

SPEC. I.

CARBONATE OF BARYT.

VAR. I. PONDEROUS EARTH, *united with carbonic acid.*

Lat. *Terra ponderoſa aerata,* or *Barytes aeratus.*

Germ. *Witherit,* ſo called by Werner, or *Luft ſaure Schweererde.*

Fr. *Terre peſante aérée.*

This kind effervefces with diluted nitric and muriatic acid, and is entirely diffolved by them.

If expofed to a ftrong heat, it parts with the carbonic acid, and combines with heat, when it becomes like lime, in fome degree, foluble in water.

Its fpecif. gravity = 4271.

Its furface can be fcratched, and fometimes fcraped, with a knife.

Its texture is fhining, radiated, fibrous. It is brittle, and femitranfparent, in a flight degree.

It is found in folid maffes, and cryftallifed. When of regular fhape, it exhibits fix fided prifms, terminating in fix fided pyramids, formed by the double truncation of the fide faces.

It is found at Anglezark, near Chorley, in Lancafhire; it is compofed of baryt, carbonic acid, calcareous earth, and a little water.

DIVISION II.

The Baryt united to fulphuric acid.

SPEC.

SPEC. II.

SULPHATE OF BARYT.

Fr. *Terre peſante vitriolée.*

Cronſt. *Marmor metallicum.*

Born. *Baryte vitriolée.*

This kind is heavier than the ſelenites, and other ſtones; it is more than four times heavier than diſtilled water; is not acted upon by any acid, except the ſulphuric, when in a ſtate of ebullition; when expoſed to heat, and to the ſun, it obtains the property of abſorbing light, which it gives out again in the dark; it is almoſt unalterable in the fire, *per ſe*; it can only be decompoſed by potaſh, or charcoal, by means of heat; it is generally interſected with metallic veins; it is found in ſolid maſſes, cryſtalliſed, approaching to an earthy ſtate, and the tranſparent kind is electric.

The following varieties are known.

VAR. I. PONDEROUS EARTH CAWK, or *Friable heavy-Spar.*

Germ. *Schweerſpath-Erde.*

Its colour is yellowiſh grey, yellowiſh and reddiſh white, reſembling ſomewhat the tripoli. It has an arid appearance; it is friable, ſometimes a little glittering; it ſoils the fingers a little.

It is found in compact heavy ſpar, near Freiberg; in Stafford, and Derby, and in the vicinity of Paris.

It contains ſometimes a little gypſum, ſilex, and lime.

VAR. 2. COMPACT HEAVY SPAR.

Ponderoſus vitriolatus compactus vel ſolidus.

Germ. *Dichter Schweerſpath.*

It exhibits various colours, ſmoke grey, yellowiſh white, cream yellow, pale fleſh colour; its form is ſometimes kidney like, with impreſſions. When broken it has a dull appearance, ſeldom glittering, or ſhining, hardly ſemitranſparent, moſtly opaque; its texture is ſhivery, approaching to lamellar; it breaks in ſharp angular pieces. It is compoſed of 83,5 ſulphate of baryt, 6,7 ſilex, 2 ſelenite, and 2 water. It is found in the mine called Iſaac, near Freiberg; in the lead mines of Derbyſhire, and Staffordſhire, &c.

VAR. 3. LAMELLATED HEAVY SPAR.

Lat. *Ponderoſus vitriolatus lamelloſus.*

Germ. *Blättricher Schweerſpath.*

Its

Its colour is pale pearl, ſmoke and yellowiſh grey, yellowiſh white, fleſh—and blood, colour.

It is a little ſhining, has a lamellated texture, is ſemitranſparent. It is found in ſolid maſſes, compoſed of ſmall lenticular cryſtals, cohering ſometimes in the ſhape of an egg. It is found at Gerſdorff, and in various mines, near Freiberg, in Saxony.

VAR. 4. GRANULAR HEAVY SPAR.

Lat. *Ponderoſus vitriolatus granularis.*

Germ. *Körniger Schweerſpath.*

This kind differs from the former, as the granular lime ſtone differs from calcareous ſpar; the lamellar particles are ſmall, and confuſedly mixed, which gives this mineral a granular appearance.

VAR. 5. COMMON PONDEROUS SPAR, or CAWK.

Lat. *Spatum ponderoſum.*

Ponderoſus vitriolatus teſtaceus.

French. *Spath peſant.*

Germ. *Gemeiner Schweerſpath.*

Cronſt. *Marmor metallicum.*

Its

Its colour is generally white, ſometimes fleſh colour, browniſh red, greyiſh black, blueiſh and yellowiſh, It is generally a little ſemi-tranſparent, often opaque; its texture is lamellar; it breaks in rhomboidal fragments.

Its ſpecif. gr. is = 4430.

It is found ſolid, interſperſed, and variouſly cryſtalliſed.

Its primitive figure ſeems, according to Rome de Liſle, to be an octaedron, compoſed of two equal pyramids, whoſe baſis is a rectangle on two ſides, the ſide faces meeting under an angle of 77°, and the two oppoſite ones, 105°, but the perfect octaedron is hardly ever found.

Varieties of regular ſhape.

a. The double four ſided pyramid.

b. The oblique angular, or rhomboidal column.

c. Rhomboidal four ſided plate.

d. The ſix ſided column.

e. The rectangular four ſided plate.

f. The eight ſided plate.

g. The ſmall rhomb with obtuſe angles of 105°.

All the cryſtals are ſhining in different degrees, have a lamellated texture, are more or

leſs

lefs femitranfparent; they are generally compofed of 84 parts of Baryt, 13 of fulphuric acid, and 3 of water.

The heavy fpar is the moft common matrix of ores; is frequently found in Saxony, Hungary, on the Harz, and in many parts of England and Germany.

VAR. 6. BARY SPAR.

Germ. *Stangen—Spath.*

Its colour is white, greyifh, and greenifh white, has a luftre fimilar to mother of pearl; it is only found in needle-fhaped cryftals, which cohere and form bars; it is femitranfparent, and was found near Freiberg, in a mine called Lorenzgegentrum.

VAR. 7. FIBROUS HEAVY SPAR.

Lat. *Ponderofus vitriolatus fibrofus.*

Germ. *Fafriger Schweerfpath.*

a. From Sicily found in gypfum and heavy fpar.

This kind has a light white colour, a little inclining to yellow; it is found tubular; has a dull furface; it is a little fhining, fometimes only glittering, femitranfparent on the edges; when

when longitudinally broken, its texture is lamellar; and when tranfverfally broken, ftriated and fibrous. The drufic cavities contain generally native fulphur.

b. From Frankftowa in Penfylvania.

This kind is of a fky blue colour; it is found compact in thin ftrata, between blueifh grey flaty clay; it is glittering, has a filk luftre; its texture is undulated fibrous, and a little femitranfparent.

Its fpecif. gr. = 3,414.

VAR. 8. LAPIS AZEROSUS.

Germ. *Aehrenftein of Blumenbach.*

This is a remarkable kind of the fnow white heavy fpar; it contains fmall oval pieces of grey compact marlftone, interfperfed in fuch a manner, that they exhibit fometimes the appearance of corn ears. When cut, it exhibits a beautiful appearance.

It was once found near Oofterode on the Harz.

VAR.

VAR. 9. BONONIEN STONE, or BONONIEN PHOSPHORUS.

Lat. *Ponderorus vitriolatus Bononienſis.*

Born. *Baryte ſpathique, griſe, cryſtalliſée, en crête de coq.*

Ital. *Pietra di Bologna.*

French. *Pierre de Boulogne.*

Germ. *Bologneſer Stein.*

Swed. *Tarninge Spath.*

Its colour is ſmoke-grey; it is found in roundiſh flat, rheniform pieces; has a lamellated texture, ſometimes radiated, but always ſpathous; it is a little ſemitranſparent, and breaks in rhomboidal ſhaped pieces.

Its ſpecif. gr. = 4,440.

It yields by analyſis 62, ſulphate of baryt 16 ſilex, 14;75 argill. earth, 6 gypſum, 0,25 iron, and 2 of water. It is only found on the mountain Paterno near Bologna.

It has been uſed for making ſtones, which are luminous in the dark, and are called in German, *Licht Magnet.*

DIVISION.

DIVISION III.

Baryt mixed with Petrolium.

Bituminous Ponderous Earth.

Terre pesante Bitumineuse.

Born. *Terre Barytique penetrée de petrole.*

The ſtones formed of this ſubſtance have a lamellated, or compact texture, and a ſhining ſurface; they are opaque; they contain petroleum, and ſilex; they are hard enough to take a poliſh like the alabaſtre; when rubbed, they emit a bituminous ſmell like hepar of ſulphur. To this kind belongs properly the ſo called *liver-ſtone, Pietra Hepatica.*

Waller. *Gypſum frictione foetidum.*

Born. Catal. Raiſon. *Baryte hepathique.*

This ſtone has a ſpathous appearance; emits ſometimes a bituminous ſmell without being rubbed. It is found in Norwegue, and in the alum

alum mines at Schoonen; its colour is white or black; it loſes its colour in the fire; does not effervesce with nitric acid; it is compoſed, according to Bergman, of baryt, ſilic. earth, alum, and gypſum.

GENUS VIII.

STRONTION GENUS.

THIS Genus includes ſuch ſtones as have the ſtrontion earth, (whoſe diſtinguiſhing properties are mentioned in the firſt part of this work, page 45.) for their baſis.

DIVISION I.

Strontion earth united to carbonic acid.

SPEC. I.

STRONTIONIT.

This ſubſtance has its name from the place called *Strontion* in Scotland, where it is found in in granit rocks, accompanied by galena and whitherit.

It is found in ſolid maſſes, has a fibrous texture; it appears as if compoſed of long fibres adhering to each other, and diſpoſed in a radiated manner; its colour is generally whiteiſh and aſparagus green, which appears deeper towards the centre of the maſs; when broken, its ſurface is a little ſhining in certain directions; it is brittle; it breaks in bar-ſhaped pieces; is a little ſemitranſparent, ſomewhat inclining to opaque; its ſurface can be ſcratched, but not well ſcraped with a knife.

Its ſpecif. gr. = 3,586.

It is not acted upon by ſulphuric acid, but is readily ſoluble in diluted nitric, and in muriatic acid, with a ſtrong effervefcence; when expoſed to heat, it does not crackle, nor ſplit aſunder; it does not melt by ſtrong heat, but it diſcovers, when expoſed to ſtrong heat, a bright phoſphoreſcent light, becomes more brittle, and loſes its greeniſh hue; it melts with borax and ſoda with ebulition.

By analyſis, I found it yielded 68 of ſtrontion earth, 30 carbonic acid, 1 of calcar. earth, and a little phoſphate of iron and manganeſe, which probably gives it a colour.

CLASS

CLASS II.

This Claſs comprehends the

SALTS,

Which are found native in, or on the ſurface of, the earth.

Theſe Salts are divided into

ACIDS—ALKALINE, and—NEUTRAL SALTS.

And the neutral ſalts are divided again into ſuch as are compoſed

1. Of acids, and alkaline ſalts;
2. Of acids, and earths;
3. Of acids and metallic oxyds.

The diſtinguiſhing properties of each of the component parts of the Salts, are mentioned in the beginning of this work.

DIVISION I.

ACIDS.

There is but one kind known, which is found in nature in a free ſtate.

VAR. I. BORACIC ACID, or *Acid of Borax.*

This ſubſtance is exhibited in ſmall hexangular, ſcaly particles, of a ſilver white colour. It diſcovers only a ſlight acid taſte; is indiſſoluble in air, melts in the fire into a vitreous maſs, and renders other refractory minerals eaſily fuſible. In water it diſſolves tardily, in ſpirits of wine more readily; its ſolution in ſpirits of wine, burns with a green flame. It is found in the earth, in various parts of Tuſcany, and near the mountain Rotundo, in the Florentine territories, where it remains, freed by evaporation from water.

It is alſo found in the rivers near the ſea, in Siena, where it was diſcovered by Mr. Höpſner.

DIVISION II.

ALKALINE SALTS.

VAR. I. SODA, or MINERAL ALKALI.

Nitrum of the ancients.

Borech of the Perſians.

Kien of the Chineſe.

It is found of a yellowiſh grey colour, moſtly in a ſtate of powder, ſeldom compact, generally mixed with clay. It is found near Debcredzin

Deberedzin in Hungary, where it is ufed for foap; it is found cryftallized in Barbary; it is ufed in glafs manufactories, for making foap, for bleaching and dying. When purified, it is employed for medicinal purpofes.

In Egypt, where it is found in great quantities, it is eaten with bread at meals. It is alfo found in abundance, in China; and, very lately, in certain undermined fortifications at Verona, Lorgna, and on the hill of San Columbano, and alfo near Pavia.

DIVISION III.

NEUTRAL SALTS.

GENUS. I.

SULPHATES,

Or fulphuric acid, united to alkalies, earths, or metallic oxyds.

A. COMBINATION OF SULPHURIC ACID AND ALKALIES.

SPEC. I.

SULPHURIC ACID, *united to foda.*

Sulphate of foda, commonly called Glauber's falt.

This falt is foluble in water, has a bitterifh cooling tafte; when expofed to a warm atmofphere, it loſes its tranſparency, and water of cryſtallization, and becomes a light white opaque powder. When perfectly cryſtallized, the cryſtals exhibit an elongated octaedron, having the pyramids near the baſis truncated; which gives it the appearance of a hexangular priſm, with unequal ſides; terminating by two faces in one point.

The ſides exhibit two rectangular, and eight trapezoid faces, or the cryſtal has twenty edges, and twelve angles. Sometimes the four principal angles, or the four oppoſite acute edges, or both together, are wanting. This ſalt is found in mineral waters, in various countries, and in the ſea, on the coaſt of Siberia.

SPEC. II.

SULPHURIC ACID *united to Ammonia.*

This is found in the crater of mount Veſuvius, and in the ſea near Siena. It is a white aſtringent ſalt, reſembling vitriolic ſubſtances. When it contains iron, it has a yellowiſh caſt.

SPEC.

B. Combination of Sulphuric Acid and Earths.

SPEC. III.

SULPHURIC ACID *united to Magneſian earth.*

Sulphate of Magneſia.

Epſom ſalt.

Bitter ſalt.

This ſalt is found in mineral waters, and alſo on gypſum near Jena in Germany; it is found in the alps, and in Switzerland, in a powdery ſtate, ſometimes in pieces, or in the ſtate of incruſtation, with a fibrous texture. It has a bitter taſte, is eaſily ſoluble in water; it decompoſes on expoſure to a warm atmoſphere; its regular figure is that of a rectangular priſm; its two end faces are covered by three angular priſms, which are placed oppoſite each other.

The ſide faces of the priſm, exhibit thin oblong pentagons, and the other four ſided faces are rectangular; the whole cryſtal has eighteen edges, and twelve angles. Its principal modification is, that the four angles are truncated, on both extremities of the priſm, &c. It is uſed in medicine as a purgative.

SPEC. IV.

SULPHURIC ACID, *united to argillaceous earth, or Alum.*

This has an acid, aſtringent and ſweetiſh taſte. It is found cryſtallized; the cryſtals are ſoluble in hot, though but little in cold, water. They tumefy when expoſed to heat, loſe their tranſparency, and become very light and ſpongy, on loſing their warer of cryſtallization.

Its regular ſhape is the perfect octaedron, which is often found modified, the middle part of the cryſtals becoming priſmatic.

It is uſed for dying, &c.

It is frequently found in Switzerland, on the Alps, and in the craters of volcanoes.

VAR. 1. HAIR SALT, VITRIOLUM IDRIENSE, OR HALOTRICHUM.

It is of a ſilver white colour; has very fine capillary cryſtals, which generally adhere, and form ſometimes compact pieces.

It has a ſilky luſtre; it is friable; has a ſweetiſh aſtringent taſte; is very light.

It is found in the quickſilver mines at Idria, in Crain, on clay, and is often coloured by cinnabar.

VAR. 2. ALSO THE ALUMEN PLUMOSUM, OR FEATHER ALUM.

French. *Alun de Plume.*

It belongs to the alum kind, and is composed of thin long ſhining fibres of a whitiſh green colour. It is found, very fine, on a high mountain in the canton of Uri.

VAR. 3. MOUNTAIN BUTTER.

Vitriolum alumen butyraceum.

Ruſſ. *Kamenoemaſſo.*

Its colour is yellow, it has a waxy luſtre; its texture is lamellar, a little ſemitranſparent, ſoft and friable; it is fatty to the touch; it has a ſweetiſh aſtringent taſte, and is found oozing out of the ſurface of the aluminous ſhiſtus.

It is found in Siberia.

C. COMBINATION OF SULPHURIC ACID AND METALLIC OXYDS, CALLED NATIVE VITRIOL.

Germ. *Natürlicher Vitriol.*

Fr. *Vitriol Natif.*

SPEC. V.

SULPHURIC ACID, *united to Oxyd of Iron, Sulphate of Iron, Martial Vitriol.*

Germ. *Eifen Vitriol.*

Fr. *Sulphate de fer.*

This falt has an emerald green colour; it is found in lumps, ftalactitical, and cryftallized; it is a little fhining, has a lamellated texture; is femitranfparent, and eafily foluble in water. When expofed to air, its furface lofes its tranfparency, and falls into a white powder, or becomes ochry and yellow.

Its regular figure is the parallelepiped, whofe faces have angles of 82° and 98°.

When expofed to a ftrong heat, it parts with the acid, on which account it is ufed in Germany, in the vitriolic acid manufactories, at Nordhaufen, and other places.

It is ufed for ink, or dying black, when mixed with galls, or other aftringent vegetable fubftances; ufed alfo for making pruffian blue, with pruffic acid.

It originates from the decompofition of fulphur pyrites, when the fulphur abforbs oxygen, and forms the acid.

It

It is found in Hungary, and on Ramelſberg on the Harz.

SPEC. VI.

SULPHURIC ACID, *united to Oxyd of Copper, called Copper Vitriol, Blue Vitriol.*

Lat. *Vitriolum Cupreum.*

Fr. *Vitriol de Cuivre, or Sulphate de Cuivre.*

Germ. *Kupfer Vitriol.*

Its colour is ſky, or deep ſapphire, blue; it is found ſtalactitically cryſtallized; it is ſoluble in four times its weight of water; the alkaline ſalt precipitates the oxyd of copper from it, in the ſtate of a fine blueiſh green precipitate.

Its regular figure is the four ſided priſm, with rhomboidal faces.

The cryſtals have a fibrous texture, they are ſemitranſparent; have a nauſeous aſtringent taſte. A poliſhed iron plate immerſed in a ſolution of it, precipitates the copper in its metallic ſtate, upon the ſurface of the iron plate. It is found in Auſtria, and near Salanta in Tranſylvania; in the ſubterraneous waters of Sweden, Ireland, and Hungary.

SPEC.

SPEC. VII.

SULPHURIC ACID *united to Oxyd of Zink.*

Native Vitriol of Zink.

Lat. *Vitriolum nativum Zinci.*

Fr. *Vitriol natif de Zink*, or *Sulphate de Zink.*

Its colour is white, reddiſh, or greeniſh white; it is found in the ſtate of powder, partly in lumps, tubular, and alſo cryſtallized. Its regular figure is the rhomboidal octaedron. It contains generally a little oxyd of iron and copper.

It is found near Sahlberg in Sweden, and near Kremnitz, at Goſlar.

SPEC. VIII.

SULPHURIC ACID, *united to Oxyd of Cobalt.*

Sulphate of Cobalt.

Germ. *Kobalt—Vitriol.*

It is of a reddiſh colour; it is difficultly ſoluble in water; it melts with borax into a blue

blue glaſs; the regular figure of this ſalt is the elongated octaedron, exhibiting a priſm.

It is very ſeldom found in the mines near Neuſohl, firſt diſcovered by Volta.

SPEC. IX.

SULPHURIC ACID *united to Nickel.*

Sulphate of Nickel.

This ſalt is generally found with martial vitriol, and originates from the ſulphurated ores of nickel; it has a deep green colour, and is difficultly ſoluble in water.

GENUS II.

NITRATES.

SPEC. I.

NITRIC ACID *united to Potaſh.*

Niter. Nitrum. Saltpeter.

Nitrate of Potaſh.

This ſalt is white or colourleſs; it is eaſily ſoluble in water; gives a cooling ſenſation to the

the tongue; when thrown upon red hot charcoal, it detonates; it is found in a ſtate of efflorescence on the ſurface of the earth, partly in the ſtate of incruſtation, partly cryſtallized; its regular figure derived from the elongated octaedron, is priſmatic. It is uſed for gunpowder, and yields the nitric acid.

It is found in Virginia, Spain, Sicily, Calabria, and the Ukraine.

SPEC. II.

NITRIC ACID *united to calcareous earth.*

Nitrate of Lime.

This earthy ſalt deliqueſces when expoſed to the atmoſphere: it is found in certain mineral waters in Sweden.

GENUS III.

MURIATES.

Or Muriatic Acid united to different Subſtances.

A. Combination of Muriatic Acid and Alkalies.

SPEC.

SPEC. I.

ROCK SALT.

Muriate of Soda.

Lat. *Sal gemmae.*

Germ. *Stein Salz.*

Fr. *Sel foſſile.*

This ſalt is found colourleſs, and of various colours, viz. greyiſh, yellowiſh, reddiſh, blue, or browniſh.

It is found in ſolid maſſes, and cryſtallized in cubes. It breaks into cubical pieces, and, when expoſed to a ſudden heat, crackles. It is found in Poland, Gallicia, Hungary, and in various other places; a certain kind of rock-ſalt has a fibrous texture, of a lavender blue, or fleſh colour.

The common ſalt, which is obtained by evaporating the water of ſalt ſprings, is of the ſame nature, only purer, and therefore more fit for culinary purpoſes. The common ſalt is uſed in potteries for glazing the ſurface of certain earthen ware. It yields beſides, the muriatic acid.

SPEC.

SPEC. II.

MURIATE of POTASH, *or muriatic acid, united to potash.*

This salt is crystallizable, and soluble in spirits of wine; it is found in mineral waters, particularly in Italy.

SPEC. III.

MURIATE of AMMONIA. *Sal Ammoniacum, or muriatic acid united to Ammonia or volatile alkali.*

Lat. *Sal ammoniacum nativum.*

This salt is found of a yellowish grey apple green, or brownish black colour; it is found in loose particles, and also in compact masses; it has a sharp taste, and emits a strong volatile smell, when rubbed with quick lime or potash; it is used for sodering, and, when purified, in medicine.

It is found in Persia, and in the craters of Italian volcanoes.

B. Com-

B. COMBINATION OF MURIATIC ACID AND EARTHS

SPEC. IV.

MURIATE of LIME, *or muriatic acid united to calcareous earth.*

This ſalt is found in mineral waters, ſometimes mixed with common ſalts; it deliqueſces when expoſed to the atmoſphere; and when mixed with common ſalt, makes it abſorb moiſture.

C. COMBINATION OF MURIATIC ACID AND METALLIC OXYDS.

SPEC. V.

MURIATE OF COPPER, *or muriatic acid united to oxyd of copper.*

This ſalt is found in ſcaly deep green ſhining particles, reſembling the green kind of mica. It is found in a mine in Saxony; a very fine ſpecimen of it is preſerved in a collection at Pavia.

GENUS

GENUS IV.

BORATES.

SPEC. I.

BORACIC ACID *united to Soda. Borax Tinkal.*

Its colour is greyiſh white, or greeniſh grey. It is found in plates, and flat ſix ſided columns, or, according to Rome de Liſle, four ſided priſms; it is ſemitranſparent, has a mild taſte, is ſoluble in water; its acid is ſeparated from ſoda, by ſulphuric acid.

It melts eaſily in the fire, and renders other minerals eaſily fuſible, wherefore it is uſed for experiments with the blow-pipe, and for ſodering.

It is found in the Alpine Sea, and in the ſnow topped mountains of Tibet.

CLASS

CLASS III.

COMBUSTIBLE SUBSTANCES.

BY this denomination are underſtood, ſuch mineral ſubſtances, as burn, or more or leſs eaſily conſume, when expoſed to heat. Some of them as ſulphur, and charcoal, are entirely conſumed by fire, and produce carbonic or ſulphuric acid; others leave a coaly ſubſtance behind; certain kinds are liquid, and of an oily nature, others hard, and of a bituminous nature, emitting, when ignited, a ſtrong ſmell. The firſt kind is not ſo eaſily inflammable as the latter. The ſolid ones are poſitive, and idioelectric. They are not ſoluble in water, nor in diluted acids.

GENUS I.

DIAMOND.

Lat. *Adamas.*

The name *adamas* is probably derived from the Greek; it ſignifies a ſubſtance which is indeſtructible, on account of its extraordinary degree of hardneſs, &c.

It is generally ranked with the gems of the ſiliceous kind, which it reſembles; but as it is found to conſume in fire with a flame like other combuſtible ſubſtances, it may, with more propriety, be ranked with the inflammable ſubſtances.

This ſubſtance, which poſſeſſes by far the greateſt degree of hardneſs, tranſparency, and luſtre, of any of the inflammable bodies, differs from the ſiliceous gems by its combuſtion, in a heat equal to 900° Fhr. and by its not being acted upon by any liquid acid.

It

It bears ſome reſemblance to the fineſt cryſtallized quartz cryſtals; it is found colourleſs, and of different colours, viz. red, greeniſh, yellowiſh, browniſh, or black. The colourleſs kinds are reckoned the moſt valuable, and the black kind, the ſcarceſt.

Its luſtre reſembles ſomewhat the metalic luſtre; it reſiſts the file, and can only be poliſhed by its own powder.

Its ſpecif. gr. = 3,100, 1,000; but that of the coloured ones, is a little more: it is idio-electric when rubbed.

It is found in roundiſh granular, and in angular pieces, ſometimes cryſtallized; thoſe from the Eaſt, exhibit generally octoedrical cryſtals, or a double four ſided pyramid; and thoſe from Brazil, exhibit dodecadral cryſtals, with rhomboidal faces, which make a ſix ſided priſm, terminated by two three ſided pyramids; in the Eaſt-Indies, they are found at Golconda, at Bengal, in the river Gouel, and in the river Sucadan, on the iſland Borneo, and at Viſapour, on the Peninſula Malacca.

The matrix is generally quartz-ſand and ironſtone, or granit; they are found at the foot of the granit mountains of Indoſtan.

Thoſe from Brazil have leſs luſtre.

The following very remarkable ſpecimens, with regard to ſize and value, may be noticed :

1. That which is in the poſſeſſion of the Great Mogul, its weight is 279 carats, and is valued at ſix millions of florins (about 540,000*l.* ſterling.)

2. That belonging to the Grand Duke of Tuſcany, weighs 139 carats, and is valued at one million of florins (about 90,000*l.* ſterling.)

3. That in the poſſeſſion of the king of Portugal, weighs 215 carats.

4. The diamond which the Stadtholder Pitt ſold to the Prince Regent, the Duke of Orleans, for the late king of France, for 1,500,000 livres. Its weight is 547 grains; and there is one in the crown of France of 106 carats.

5. Mr. Gregor Saffraz, of the family of Gogia Minazian, was in poſſeſſion of a diamond, from the Eaſt Indies, weighing 779 grains—And

6. The rough diamond from Brazil, in the poſſeſſion of the King of Portugal, weighs 1680 carats.

GENUS

GENUS II.

BITUMINOUS SUBSTANCES, or BITUMINA.

In German, *Erdharzige Subſtanzen.*

DIVISION I.

LIQUID BITUMENS.

SPEC. I.

NAPHTHA. BIUTMEN. PETROLEUM.

This is a liquid mineral, oily, colourleſs, tranſparent ſubſtance, having a ſharp taſte, and diſagreeable ſmell. It is lighter than water, and ſpirits of wine.

Its ſpecif. g. is generally = 847.

At a ſhort diſtance from flame, it catches fire; it is not ſoluble in ſpirits of wine, nor miſcible in water; when expoſed to the atmoſphere, it becomes firſt yellow, then of a deeper colour, and then evaporates.

It is found frequently in Perſia and Media, where it oozes like water out of ſand-ſtones; and near Baku, on the weſtern coaſts of the Caſpian Sea. The fineſt ſort is brought from a peninſula in that ſea.

SPEC. II.

IMPURE and COLOURED PETROLEUM, *rock oil.*

Petroleum impurum.

Waller. *Bitumen fluidum.*

Its colour is generally fire red, or browniſh black; it is of a thicker conſiſtence, than the Naphtha, and is not ſo tranſparent; it is fatty to the touch—lighter than water, but heavier than ſpirits of wine; it has a bituminous ſmell, is leſs inflammable than Naphtha, and mixed with heterogeneous particles.

This kind is alſo collected from the ſurface of certain ſprings, and near Baku, on the weſtern coaſt of the Caſpian Sea, alſo in Perſia, and on the Peninſula Boral; and Abſcheron in Siberia, near Semenowa; in Weſtphalia; in Bavaria, near the Tegern Sea; in Switzerland, near Bern, and Chateaunoy; in Scotland, and in in various other places, is found oozing out of coal flötz, and floating upon certain hot wells.

The yellow kind is generally found near Modena in Italy; the red is found in Gabien, and in Alſatia; and the brown and blackiſh kind in England, Italy, France, Germany, and Sweden.

SPEC. III.

TAR.

Germ.	*Bergtheer.*
Waller.	*Bitumen Malta.*
Cronſt.	*Petroleum induratum.*
French.	*Petrole tenace.*

This kind is of the conſiſtence of treacle; is of a blackiſh brown colour, opaque, and has a very ſtrong ſmell; it ſeems to originate from the foregoing ſpecies, which, by long expoſure to air, has loſt its volatile particles, and thus obtained a thicker conſiſtency.

It is found at Malta, and at Baikal near Barguſen, where it is depoſited by the ſea; it is alſo found on the ſurface of ſprings in the duchy of Modena, and in various parts of France, Germany, and Switzerland; in Dauphiné, and Pietramala.

 It

It is uſed for varniſhing ſhips; and of late, as a remedy for certain diſeaſes.

DIVISION II.

SOLID BITUMENS, *or* FOSSIL RESINS.

Theſe ſubſtances, in conſiſtence and appearance, are like the reſins obtained from vegetable balſams; they are produced by the inſpiſſation of *Petroleum*; they are generally ſhining, not ſoluble in ſpirits of wine, nor in water; they are brittle, and melt by heat, burn, and leave an acid ſubſtance behind; when rubbed and held near a glaſs, they emit electric ſparks; and ſome of them have a vitreous luſtre.

SPEC. IV.

BITUMEN.

Germ. *Bergpech, Judenpech.*

Born. Cat. Rais. *Petrole ſolide.*

Waller. *Bitumen aſphaltum.*

It derives its name *Aſphalte*, from a lake called *Aſphaltide* in Judea. It exhibits a hard black ſhining reſinous-like ſubſtance. It is very

very brittle; when expoſed to heat, it melts, burns like pitch, and then gives the ſmell of burnt amber. It is principally found on the Dead Sea.

Its ſpecif. gr. is = 1,104.

It is found on the lakes of Judea, China, Denmark, and Sweden; it was uſed by the ancient Egyptians for making mummies, and it is now uſed, when diſſolved in oil, for varniſhing coach leather, and for certain purpoſes in medicine.

SPEC. V.

GAGAT.

Bitumen Gagates.

Born. Cat. Rais. *Petrole compacte, &c.*

This ſubſtance ſeems to be a variety of the aſphalt; is leſs ſhining, much harder, but not ſo brittle; it takes a poliſh like marble, and is, in ſome places, made into buttons and other veſſels.

It melts in the fire like aſphalt, and when burnt, emits a thick greyiſh black ſmoke, and a bituminous ſmell. It is found in England, France, Italy, and in various parts of Germany.

It

It is lighter than sea water; when broken, it has a conchoidal surface: it is found in the earth in pieces, in Sumatra; the river Wolga, above Syfran; on Irtysch near Jamischewa, in Daurien; on the river Tschikoi, where the Uruluck falls into it.

SPEC. VI.

ELASTIC BITUMEN.

Bitumen Asphaltum Elasticum.

Germ. *Elastisches Erdharz.*

This substance is of a brown colour, has no lustre, and is very elastic, is soft enough to be compressed with the fingers, and burns with a light flame; it is found near Castleton, in Derbyshire, in calcareous spar with Galena, where two kinds are found, one resembling the cahutschuk, or *resina elastica*, which burns with a bright flame; it becomes softer by heat, and is generally accompanied with lime-stone, and calcareous spar.

The other kind is not so compact, is of a lighter brown colour, and rather spongy.

SPEC.

SPEC. VII.

MINERAL MUMMY.

Its colour is blackiſh brown, more tough than aſphalt; has rather a pleaſant balſamic ſmell; is only found in clifts of rocks at Choraſſau on the river Caucaſus, which is acceſſible but once a year, and therefore this ſubſtance is very ſcarce.

Mr. Herman has found it on the water of a ſpring near Straſbourg.

It is ſoluble in ſpirits of wine. A ſimilar ſubſtance has been found in Lancaſhire.

GENUS

GENUS III.

COALS, OR SUBSTANCES CHIEFLY EMPLOYED FOR FUEL.

SPEC. VIII.

COAL.

Lithantrax.

Fr. *Charbon de Terre, houille.*

Germ. *Stein kohle.*

Waller. *Bitumen Lithantrax.*

This coal is black, compact, more or leſs ſhining, and moſtly brittle. It burns with a yellowiſh and blackiſh ſmoke; its combuſtibleneſs depends on the quantity of oil, or bituminous matter, which it contains. A particular kind ſeems to be formed from a ſlaty clay, found under ſtagnant waters, and impregnated with the vapours of petroleum, which were ſet loſe by ſubterraneous heat. Other kinds exhibit many marks, which ſhew that they have chiefly originated from vegetable ſubſtances, as they are often found containing charcoal, &c.

Coal forms large ſtratified or flötz mountains near Newcaſtle; is moſtly covered with ſlaty clay. It is alſo found in various other clayey flötz mountains, which had formerly been covered, for a long time, with ſtagnant water or lakes.

Coals

Coals are moſt frequently found in mountains, containing lava and columnar baſaltes, which ſhew that volcanoes which are now extinct, exiſted there formerly.

Indeed it ſeems to be probable, from certain marks, that all places which yield coals, were formerly covered with ſtagnant lakes; at the bottom of which, great quantities of plants and ſea animals of all kinds, were collected, and that the oil ſeparated by the water, from thoſe plants and animals, had contributed, not only to the formation of the coal, but alſo to the formation of other ſulphuric combinations, or products, which are found there, and which, by ſubterraneous fire, had been altered.

Coals yield alſo volatile alkali, water, and oil; and when burnt, yield aſhes, compoſed of feruginous clay, or, ſometimes, ſlaggy porous maſſes of different kinds.

The coals found in the upper part of the coal flötz, burn quicker, but give not ſo much heat.

The following varieties of coals may be noticed.

VAR. I. SLATY COAL.

This kind has a ſlaty texture, a fat luſtre, is jet black, ſtains a little, and reſembles, in other

other reſpects, pitch coal. When tranſverſely broken, it exhibits a conchoid ſurface.

VAR. 2. PITCH COAL.

Lat. *Bitumen Lithantrax piceus.*

Germ. *Pech-Kohle.*

This kind is alſo jet black, ſhining, and ſometimes a little variegated. It is found compact, in large beds; when broken, it appears conchoidal.

VAR. 3. SHINE COAL.

Germ. *Glanz Kohle.*

It is generally of an iron-black colour; when broken, it has a conchoidal ſhining ſurface, ſomething of a metallic luſtre, and breaks in cubical fragments; the fragments are brittle. It is found compact, forming flötz mountains; ſometimes found interſperſed, and of a cubical ſhape.

VAR. 4. LAMELLAR COAL.

Germ. *Blätter Kohle.*

It is of a deep black colour, ſtrong, ſhining, has a lamellated texture, and breaks in rhomboidal

boidal pieces. It has often ſomewhat the appearance of the rainbow, and is very brittle. It is found near Burg, and Wurgewitz, near Dreſden, near Ilmenau, &c.

SPEC. IX.

BITUMINOUS WOOD. *Bovey Coal.*

Waller. *Lithantrax ligneus.*

Fr. *Bois foſſile bitumineux.*

Germ. *Bituminöſes Holz, Braune Kohle.*

Its colour is liver brown, or blackiſh brown; it reſembles wood; its ſurface is rough, and longitudinally ſtriated; its texture ſhivery; it is formed from dead wood, penetrated by bitumen, which has prevented its entire decompoſition; its colour and hardneſs differ, according to the quantity of bitumen, which it has imbibed. It is found in Iceland, in beds ſuch as other coals are found in.

VAR. 1. BITUMINOUS WOOD EARTH.

Its colour is brown, and ſometimes blackiſh; is friable, and ſeems to be compoſed of compact powdery particles; it ſtains; it is found in Siberia, and near Merſeburg.

SPEC.

SPEC. X.

TURF.

Fr. *Tourbe.*

Waller. *Humus fibroſa combuſtibilis.*

This is an irregular mixture of vegetable and animal ſubſtances, which have been collected at the bottom of ſtagnant waters, or moor ground, and which have in time been changed into a bituminous ſubſtance. It reſembles a blackiſh, coarſe earth, cut into longiſh rectangular pieces, of a foot long; are uſed for fuel.

Holland, Zeeland, and Ooſtfrieſland, are the beſt places for digging and preparing the turf. There is alſo another kind of turf, apparently compoſed of fibrous roots, moſſes, and graſſes. It is found in moor ground, more or leſs impregnated with petroleum, or bitumen; it is generally of a browniſh black colour, frequently found in Germany, and in Grönland.

GENUS

GENUS IV.

COMBUSTIBLE SUBSTANCES OF A DIFFERENT NATURE FROM THE FOREGOING.

SPEC. XI.

AMBRA. *Ambrofiaca.* Lin.
Fr. *Ambre-gris.*

This fubftance appears as a fcaly, compact, greyifh, pale yellowifh, or blackifh, opaque, mafs, without luftre. It breaks eafily, but cannot be readily reduced to powder; its texture is granular; it melts like wax, and fticks to the teeth like maftich; has a fragrant fmell, but no particular tafte. Its fpecif. gr. = 926; it is fomewhat foluble in fpirits of wine, by the affiftance of heat, and gives the fpirits a yellowifh brown colour.

The grey kind is collected by the Molucks, and the whiteifh and blackifh kinds are found near Nicobar, on the fea coaft, and on the furface of the fea.

Some naturalifts fuppofe it to originate from animals; others, from vegetables; but according to the beft accounts, it belongs to the mineral kingdom.

It is generally found in fmall lumps in the Eaft Indies. A piece of it of more than an ounce weight, is very dear. A mafs of it weighing 225 pounds, was ſold for 52,000 livres.

It was formerly uſed in medicine, and is now uſed as a perfume.

SPEC. XII.

AMBER, *Succinum. Electrum.*

Fr. *Amber jaune.*

This ſubſtance is compoſed of bitumen, and a peculiar acid. Its colour is generally honey yellow, which is ſometimes pale and deep; it is found tranſparent and ſemitranſparent; is ſometimes milky and opaque. Its ſpecif. gr. = 1083.

It is found ſolid, but never cryſtallized; it poſſeſſes various degrees of reſplendence, has a vitreous appearance, and when broken, exhibits a conchoidal ſurface. It is brittle, and can eaſily be reduced to powder; it is highly electric; melts with more difficulty than the other bitumens. While burning, it emits very pungent white vapours.

It is often found encloſing inſects of the ſmall kind; it is found at a conſiderable depth from the ſurface of the earth, in Pruſſia, and on on the ſhores of the Baltic ſea; and, frequently, in Eaſt Pruſſia, in layers of bituminous wood. It is alſo found in great quantity, in the two lakes, called the Curiſh and Freſh Haff. It may alſo be found on the eaſtern ocean, and on the ſhores of it; and, very pure and good, at Madagaſcar.

It is ſuſceptible of a good poliſh, and is therefore made into various veſſels, necklaces, trinkets, and other ornaments.

It is alſo uſed in medicine; is ſuppoſed to attract the catarrh.

There is another ſpecies of it called Copal.

Waller. *Succinum Copal.*

Electrum Copal.

It has the ſame properties as the amber, but being ſofter, may be more eaſily cut into veſſels. It is found near the coaſt of Guinea, at conſiderable depths below the ſurface of the earth.

N. B. It muſt not be confounded with the copal produced by a certain tree.

SPEC. XIII.

HONEY STONE.

Bitumen melleum.

Germ. *Honig ſtein.*

 This

This ſubſtance was firſt diſcovered by Mr. Werner, in bituminous wood, in the principality of Mansfeld. It reſembles in colour, texture, and tranſparency, the honey-yellow amber. but it differs from it in this, that it cryſtallizes in ſmall double four ſided pyramids, and when held in the flame of a candle, does not burn, nor does it emit a ſmell like amber; it becomes only white, opaque, and very brittle. It is alſo found in Switzerland, in Aſphalt, and in layers of bituminous wood.

SPEC. XIV.

SULPHUR.

This ſubſtance has of late been conſidered as a ſimple ſubſtance. It is a compact, brittle, ſubſtance, generally of a yellow colour; it is found in compact, opaque maſſes, and alſo cryſtallized, when it is ſemitranſparent; it becomes liquid at 244$_{\circ}$ Farhr. when it appears tranſparent, and of a red brown colour; it kindles and burns with a more intenſe heat, when in contact with air that contains oxigene; it combines with the oxigene, and forms the ſulphuric acid; if heat be applied, it decompoſes water, by uniting with its oxigene; the hydrogene

hydrogene is therefore let loose, and appears in the state of inflammable gas.

It has a strong affinity to certain metals, with which it is frequently found combined in nature, as will appear by the different pyrites; it is not soluble in water, nor in diluted acids; it is electric; it burns with a blue flame, leaving, if pure, scarce any *residuum*; it is soluble in fat oils, and in costic or pure alkalies.

It is found in the craters of volcanoes, and in several mineral waters, partly dissolved in hydrogene gas, forming hepathic air, which is found in certain mineral waters.

It is also found in mount Vesuvius, and Ætna, and in rocks of selenite; it is found in small pieces in gypsum, in layers of clay, in lime, and in semitransparent eight sided capillary bodies, united together, or in rhomboidal crystals.

The best sulphur mines are found in Sicily and Naples.

Its use in common life is sufficiently known.

Varieties of Sulphurs.

VAR. I. NATIVE SULPHUR. *Brimstone.*

Lat. *Sulphur nativum commune.*

Germ. *Gediegener Schwefel.*

Waller. *Sulphur vivum flavum.*

Ital. *Solfo nativo.*

Fr. *Soufre natif.*

This is of a pale yellow colour, more or less semitransparent, more or less pure.

Its specif. gr. = 2033.

It is found compact, frequently with alabaster and gypseous spar, partly crystallized in double eight sided truncated pyramids. Sometimes it exhibits only three sided pyramids, or four sided columns; is sometimes of a tabular, cubical, or stalactitical shape.

It is found in the craters of volcanoes.

In Iceland, and other countries, there are found whole layers of sulphur, of a foot and more in diameter, partly in a powdery, partly in a crystallized state, near the surface of the earth.

It is found in all the parts of the world. Sulphur is also found united to arsenic, when it exhibits a red colour.

VAR. 2. NATIVE HEPAR OF SULPHUR.

This is a mixture of lime or potash and sulphur; it has the smell of rotten eggs; is mostly of a grey or yellowish colour; has an earthy appearance.

It

It is generally found near the ſulphurous mineral waters, and alſo in volcanoes.

Sulphur united with clay, is ſometimes found in the mountains of Nertſchinſk, and in the mines of Schilka.

SPEC. XV.

COAL BLENDE.

Fr. *Charbon de Terre incombuſtible.*

Germ. *Kohlen blende.*

This ſubſtance reſembles coal; is generally of a deep iron black colour; has a ſtrong metallic luſtre, a ſlaty texture; it breaks partly in cubical pieces; is opaque, brittle, ſtains a little, and is almoſt incombuſtible in fire. It was lately found in various parts of Europe, frequently near Gera, alſo in Walliſer, and Piedmont.

SPEC. XVI.

BLACKLEAD. PLUMBAGO.

Werner. *Graphit.*

Fr. *Crayon noir.*

Lat. *Graphites.*

This substance is generally of an iron grey colour, partly blackish, has a slight metallic lustre; is opaque, greasy to the touch, stains and suffers impressions from the nail. It has a granular texture. When exposed to an open fire, it burns with a reddish flame, and emits beautiful sparks, and a smell of sulphur; it is then consumed, all but a little siliceous earth, and iron.

The finest kind which is used for the English pencils, is found at Keswick, in Cumberland.

It is compact, has a fine grain, and is rather a little flexible. Its specif. gr. is = 2089. It is not acted upon by acids.

Other kinds have a scaly texture; the common kinds are used to blacken stoves, and to make Ipser crucibles for melting metals; it is also found in large layers in the German alps.

MOUN-

MOUNTAINS IN GENERAL,

AND THEIR

PRINCIPAL COMPONENT PARTS.

WE ſhall premiſe the following obſervations reſpecting mountains:

1. Their proximate component parts can generally be diſtinguiſhed with a naked eye, without chemical teſts.

2. Their component parts are not chemically or intimately combined.

3. Their compact ſtate ariſes from the attraction and coheſion of component parts, brought in contact, when they were all or a part of them in a fluid ſtate, or when they were cemented by heterogeneous ſubſtances, and that heat was occaſionally applied; or it ariſes more or leſs from alteration by fire.

As the ſubſtances of which mountains are compoſed, are of a different nature, and conſe-quently

quently exhibit a different appearance and ſtructure, it has been thought proper to treat of the ſituation, principal and accidental component parts of mountains, under the following heads; and hence the following diviſion into

a. Primitive.

b. Secondary, or Flötz mountains.

c. Alluvial mountains, and

d. Volcanic mountains.

DIVISION I.

PRIMITIVE, PRIMORDIAL, OR ORIGINAL ROCKS OR MOUNTAINS.

Theſe denote ſuch as are apparently of greater antiquity, than thoſe which generally reſt upon them.

They ſeem to be formed by precipitation or depoſition.

They are generally very high mountains, and ſhew many marks of derangement, ſubſequent to their formation.

Their component parts are of different ſizes, irregularly mixed; they break into differently ſhaped pieces, though they are generally of the ſame compoſition. Some have a lamellar appearance, and are called primitive rocks of a ſecondary formation. They contain no petrefactions,

tions, and are therefore ſuppoſed to have exiſted previous to the formation of animals and vegetables.

DIVISION II.

SECONDARY ROCKS, FLOETZ MOUNTAINS, OR REGULARLY STRATIFIED MOUNTAINS.

Theſe ſeem to be of a later formation, formed alſo by precipitation; they conſiſt of ſtratified layers, containing often petrefactions of animals and vegetables, and alſo metals.

Theſe mountains ſhoot up irregularly; they are of various compoſitions; their general component parts are mentioned under proper heads.

DIVISION III.

ALLUVIAL MOUNTAINS.

Theſe are ſeemingly formed by depoſition, and at a later period of time than thoſe juſt mentioned.

They are found near coaſts, and on the beds of rivers; they are rather flat, and have the cavities, left by the ſecondary ſtrata, or flötz mountains, filled up; they ſeldom contain petrified ſea products; they contain however decompoſed

compoſed river, and land ſnails, bones of land animals, and various kinds of plants, and are ſometimes impregnated with bitumen.

DIVISION IV.

VOLCANIC MOUNTAINS.

Theſe have their origin from ſubterraneous fire.

They appear inſulated, and are moſtly very high, ſteep, barren, or naked, and exhibit funnel ſhaped cavities or craters on their tops or ſummits, out of which different ſubſtances are thrown, which, according to their nature, have been variouſly altered by ſubterraneous fire.

DIVISION I.

Subſtances belonging to the component parts of the

PRIMITIVE MOUNTAINS, OR ROCKS.

1.

GRANIT.

Cronſt. *Saxum compoſitum Feldſpata, Mica, & Quartzo, &c.*

By this denomination is underſtood a ſtone, that is chiefly compoſed of *quartz, feldſpar,* and *mica.*

mica. The component parts are generally irregularly mixed, and of various ſizes.

The *quartz* and *mica* are found of different degrees of hardneſs and colour; the *feldſpar* exhibits ſometimes a regular ſhape. The *granit rocks*, which are compoſed of theſe ſtones, are more generally found than other rocks; they are found in the higheſt and deepeſt parts of the earth. The *granit* ſtrikes fire with ſteel, and is not readily acted upon by any acid, except the fluoric; it takes a poliſh, and may, on account of its hardneſs, ſerve for various purpoſes in common life.

The component parts of the granit are ſeldom found lamellated*. The primitive granit contains no petrifactions of animals, vegetables, or metals; but that granit which is of a ſecondary formation, contains occaſionally *ſhörl*, *garnits*, *topaz*, *rockcryſtal*, *amethyſt*, *opal*, and *adamantine ſpar*.

2.

Sienit.

This ſtone forms alſo rocks; it is compoſed of *feldſpar* and *hornblende*; it contains now and then *quartz* and *mica*.

The hornblende characterizes this ſtone.

3.

* Mr. Ch. Hatchett, a gentleman well verſed in Mineralogy, has lately deſcribed a granit, which he diſcovered while on his travels abroad, in which the component parts are diſpoſed in a diſtinct ſtratified manner.

3.

Gneiss.

Born. Cat, Rais. *Granite feuilletè.*

This ſubſtance has the ſame component parts as the granit; but the *quartz*, *feldſpar*, and *mica*, are not in a granulated ſtate; it exhibits a ſlaty or lamellated texture; it is leſs hard than the granit, is divided by moiſture into lamellated pieces; in fire, it becomes harder, and of a red colour; it contains the mica in a greater proportion than the granit. It forms large chains of rocks, and contains metallic veins, occaſionally alſo *garnits*, *ſhörl*, and *turmalin*.

The mountains formed of it, generally reſt upon granit mountains.

4.

Micaceous Slate, or Shistus.

It is compoſed of *mica* and *quartz*; it contains occaſionally *clay*, *ſteatite*, *green garnits*, *ſhörl*, and *radiated ſtone*, which is called in German *Strahlſtein*. The *micaceous ſhiſtus* exhibits a ſlaty texture; has ſometimes an undulatory

appearance;

appearance; it generally refts upon *porphyre* and *granit*; is chiefly covered with *argillaceous flate*, *fand*, and *lime-ftone*.

Another kind of the fame compofition, but not exhibiting a flaty appearance, is called in German *Geftell-ftein*, from being ufed for the purpofe of coating or making the infide of large melting furnaces. It is found in the Alps, of various colours, according to the ftate of its component parts. In the Spanifh Pyrennees, it is of a fmoke-grey colour. In Norwegue, whiteifh; in Tyrol, yellowifh; and on Lago Maggiore, afh grey. The latter kind is called *Beola*, and is ufed for various purpofes.

5.

Hornblende Shistus.

This ftone is compofed of *hornblende* and *quartz*. It is found frequently in *rocks of gneifs* and *micaceous fhiftus*, near Miltitz, in the environs of *Mifnia*.

There are large beds of this ftone found refting upon *lime-ftone*.

6.

6.

Argillaceous Shistus.

This ſtone is chiefly compoſed of *common clay*, and differs from the other kind of argillaceous ſhiſtus, which is of a later formation. It forms mountains belonging to the primitive ones, ſuch as the *altai mountains* or *rocks*; it alſo forms mountains in Hungary and Saxony, which are generally placed in alternate order with mountains of *granit*, *gneiſs*, *micaceous ſhiſtus*, and *lime-ſtone*. It often reſts upon flat mountains of ſand ſtone.

7.

Porphyre.

This conſiſts of a maſs compoſed of *indurated clay*, *horn-ſtone*, *jaſper*, *quartz*, *obſidien* or *pitch-ſtone*, through which *feldſpar*, *quartz*, and *hornblende*, and occaſionally *mica*, are interſperſed.

It is found of various colours; is a little acted upon by acids.

Mr. Karſten diſtinguiſhes the following varieties:

a. *Porphyre* is principally compoſed of *clay*, and contains *feldſpar* with a little portion of *mica*;

mica; sometimes the *feldspar* alone, or the *feldspar* mixed with *quartz* and *garnits*. It contains occasionally *calcedony*, *cryſtallized quartz*, and *amethyſt*; but these ſubſtances are ſeldom found in the interior parts, moſt generally on the outſide.

b. Porphyre, whoſe principal baſis is *jaſper* mixed with *feldſpar*, is alſo occaſionally mixed with *quartz* and *hornblende*.

c. Porphyre, whoſe principal baſis is *hornſtone*, mixed with *feldſpar* alone, or with *quartz*, or *hornblende* and *quartz* together. It contains accidentally *calcedony*, *garnits*, and *zeolithe*.

d. Porphyre, chiefly compoſed of *quartz*, mixed with grains of *feldſpar*.

e. Porphyre, chiefly compoſed of *pitch-ſtone*, mixed with *feldſpar*, and *leuzit*.

The general and eſſential component part of the *porphyres* is the *feldſpar*, which it generally contains in a cryſtallized ſtate.

The *feldſpar* is ſometimes of a reddiſh colour, ſometimes white.

Quartz is always more or leſs tranſparent; and *mica* ſeems to be peculiar to the *porphyres*, as the *hornblende* is to the *porphyre* of *hornſtein*.

In Joachimsthal in Bohemia, *porphyre* is found betwixt *micaceous ſhiſtus*, and near the

Halſbrücke in the environs of Freiberg, incloſed in *gneiſs*.

The *ſaxum metalliferum* of Born, is ſofter than *porphyre*, and is cemented by *clay*. The metalliferous mountains of Tranſylvania and Hungary, are chiefly compoſed of it. It contains diſtinct parts of *quartz*, *lythomarge*, *ſhörl*, and *feldſpar*.

8.

Porphyry Shistus.

This is chiefly compoſed of *clay* mixed either with the grains of *feldſpar* alone, or accompanied with *quartz* and *hornblende*, very ſeldom with *zeolithe*.

It has a coarſe texture, either parallel, or curved, and a ſlaty appearance.

The mountains compoſed of porphyry ſhiſtus, are often found on flat land ſcattered, and detached like the tops of mountains. Sometimes alſo they form large mountains; they are generally found near the baſalt mountains, and ſometimes near the granit and gneiſs mountains.

9.

SCHNEIDE STEIN. *By the Germans.*

This ſtone is chiefly compoſed of *ſteatite, mica,* and *talc,* occaſionally mixed with *feld-ſpar, garnits,* and *turmalin.* It has generally *micaceous ſhiſtus, geſtell'ſtein, granit,* or *horn-ſtone* for its baſis; the mountains it forms are generally found naked, ſometimes they are covered with ſlate or lime-ſtone.

10.

QUARTZ.

This ſtone ſeldom forms mountains by itſelf; when it does, it is diſtinguiſhed from the *quartz* of the *ganges* by a coarſer texture, and by a greaſy luſtre. It is alſo found, occaſionally, approaching to the nature of *granit,* as it is found, occaſionally, to contain ſeparate pieces of *feldſpar* and *mica.*

11.

PRIMITIVE LIME-STONE.

This is a lamellated lime-ſtone, which exhibits ſometimes a fine grained texture, reſembling compact lime ſtone. It is at times mixed with *argillaceous ſhiſtus*, *hornblende*, *aſbeſt*, *ſteatite*, *ſerpentine*, *quartz*, *mica*, *calcar. ſpar*, and *garnits*.

This kind of rock is frequently found near mountains of argillaceous ſhiſtus, and in ſeparate layers, of different ſizes, in gneiſs and micaceous ſhiſtus. In Styria, and alſo in Carinthia, and Carniola, and in Italy, it forms large extenſive mountains, reſembling primitive mountains. This kind of lime ſtone rock muſt not be confounded with the lime ſtone of a different origin, which is found near Blanckenburg, Steinach, in the foreſt of Thuringuen, which contains trochits; near Clauſthal, and in a cavity called Baumanſhöhle, which contains calcined bones.

12.

Serpentine.

This ſtone forms alſo mountains, or part of mountains, which are compoſed of *ſilex*, *clay*, *lime*, and *ferugenous earth*.

This ſtone contains occaſionally *ſteatite*, *aſbeſt*, *amianth*, *talc*, *lythomarge*, *garnits*, *mica*, *calcar. ſpar*, *quartz*, *hornblende*, and *ſulphur pyrites*. It forms partly ſeparate mountains,

leaning

leaning on mountains of granit, gneiſs, and ſand ſtone. Sometimes it forms mountains of conſiderable heights, but never very extenſive.

13.

Topaz Rock.

This is compoſed of *topaz*, *quartz*, *ſhörl*, and *lythomarge* There is only at preſent, one ſpot known where this ſtone forms conſiderable parts of mountains, which is at *Schneckenſtein*, near *Auerbach*, on the metallic mountains, called in Germ. *Erzgebürge*, in Saxony.

14.

Trapp.

This is a mixed ſtone, compoſed of *hornblende*, *quartz*, and *feldſpar*, in which the *hornblende* predominates, and appears ſo intimately combined with the *quartz*, that they can hardly be diſtinguiſhed. The *feldſpar*, which it contains, is found in long grains, as in the *porphvry ſhiſtus*. The *feldſpar*, however, is very rarely found in theſe ſtones, and is by that means diſtinguiſhed from the *ſienit* and *porphyry*.

It contains accidentally *calcareous ſpar*, *micaceous iron ore*, *magnetic iron ſtone*, and *ſulphur pyrites*.

Trapp ſeldom forms long contiguous mountains; it generally forms the tops of large mountains; ſometimes it forms ſcattered parts of rocks; when found covered, which ſeldom happens, its covering is ſand ſtone of a *clay cement*, *granit*, or *primitive lime ſtone*.

DIVISION II.

Subſtances of which are chiefly compoſed, the

FLÖTZ, OR REGULAR STRATIFIED MOUNTAINS.

1.

WACKE.

This ſtone comes under the head of the argillaceous genus, and belongs to the ſimple compoſed mountains; it is found partly upon gangues, partly in the ſtate of layers, under, and ſometimes between, baſalt. It is found often approaching to the nature of baſalt.

2.

2.

Basalt.

This is alſo a ſimple kind of mountain, which is compoſed of *ſiliceous*, *argillaceous*, *magneſian*, *calcareous*, and *ferugenous*, earth. It contains occaſionally *olivin*, *hornblende*, *calcareous ſpar*, *calcedony*, *zeolithe*, *mica; bole*, *ſpathous iron ſtone*, *marl*, *ſulphur pyrites*, *petrifications*, and impreſſions of leaves.

The baſalt mountains are frequently found in Saxony, Thuringuia, Heſſe, &c. They generally form very ſteady cupolas, which reſt upon wacke, clay and ſand, or upon coal-flötz. They contain lime-ſtone, horn-ſtone, and ſand-ſtone.

3.

Almond Stone.

This is a mixed kind of ſtone, which is chiefly compoſed of wacke, but it approaches ſometimes to the nature of baſalt. This ſtone contains various other ſubſtances, in the ſtate of ſtones more or leſs rounded and of different ſizes, reſembling almonds.

Mr. Kerften mentions the following varieties.

A. Basaltic Almond Stone.

Though Mr. Karften confiders this variety as a harder kind of almond ftone, than generally met with, yet, by feveral mineralogifts, it has been defcribed as bafaltes, for it is fometimes difficult to decide, whether it is more properly called bafalt, or almond ftone, as both kinds refemble each other fo much. As to colour, it is found reddifh brown, deep grey, and greyifh black. Sometimes it contains globules of calcedony, fometimes *calcareous fpar*, *hornblende*, and *zeolithe*, fometimes *calcareous fpar*, and maffes of *green earth* of eliptic fhape, fometimes botrioid-fhaped *rock cryftal.*

B. Common Almond Stone.

To this variety belong the fofter kinds, whofe principal component part is indurated clay. In this ftone there are found occafionally, *calcedony*, *fteatite*, *lythomarge*; fometimes grains of *calcareous fpar*. It is found of a greyifh, reddifh grey, and of a pale greenifh grey colour.

Moun-

Mountains formed of this ſtone, are found in the county of Glatz, in Upper Lauſatia; at Albertſdorff, in Bohemia, near Schlackenpert, and Carlſbad; in Saxony, near Zwickau; in the biſhopric of Fulda; Heſſe; near Franckfurth on the Mayn; in the Palatinate; in Derbyſhire; in Iceland; and on the Feroe iſlands, where it reſts upon coals.

4.

Slaty Clay, *or ſtratified argillaceous Shiſtus.*

This ſtone is an argillaceous ſhiſtus, which ſoftens in water, and contains generally impreſſions of ſhells, and plants. It is generally found under and over coal flötz; it is known by the name of *herbaceous ſhiſtus.* Germ. *Kräuter Schiefer.* In Saxony it is found in coal flötz, near Dreſden, and at Planitz, near Zwickau.

5.

Aluminous Shistus.

This is an argillaceous ſhiſtus, mixed with *ſulphur pyrites*, and occaſionally *bitumen.* *Clay* is always the predominating part; *ſulphur*

phur pyrites is ſometimes found in large quantities, ſometimes only in ſmall pieces interſperſed, and ſometimes ſo intimately mixed, that it can hardly be diſtinguiſhed from the laſt mentioned ſubſtance, except by the aluminous taſte.

It is often found in the ſtate of decompoſition, as it abſorbs oxygen from the air, or other gaſes; it becomes acidified, and forms with the clay, the aluminous matter which efferveſces out of its ſurface.

It belongs to the flötz mountains, and is frequently found in Norway, Sweden, and in various parts of Germany.

6.

Flöts Lime Stone.

A. Compact Lime Stone.

This ſtone generally changes into *marl,* ſeldom into *ſand ſtone.*

In Thuringuia, and in the adjacent countries, large flöts of bituminous marl ſhiſtus are found. It generally exhibits marks of heterogeneous ſubſtances; diſplays alſo dentritical figures, and is often mixed with *granular lime*

lime ſtone, with *cryſtallized calcareous ſpar*, *ſulphur*, and *ſulphur pyrites.*

B. Swine Stone.

Germ. *Stinck ſtein.*

This is a lime ſtone intimately mixed with *petroleum*; it generally reſts upon mere *calcareous earth*, of an aſh grey colour.

7.

Marl.

This ſubſtance is compoſed of *lime* and *clay*.

a. Indurated marl.

This ſtone contains often *echinits*, *orthoceratites*, *amonites*, &c. Sometimes impreſſions of plants and fiſhes; it is not met with in lime and coal flötz.

In Saxony, it is principally found in the mountains of copper-ſlate, near Eiſleben, in Thuringuen, Sangerhauſen, Buttendorf, Ilmenau; in the lime rocks of Werau, and in the coal mountain of Dreſden, where it bears provincial names, viz. *zechſtein*, *hammerkalch*, and *kohlenſtein*, &c.

b. Bitu-

b. Bituminous marl ſhiſtus.

This is a ſlate, compoſed of *clay*, *lime*, and *bitumen*; it contains often impreſſions of fiſhes and ſea plants; *native copper*, *copper pyrites*, *vitreous copper*, *copper green*, *azure copper*, and *variegated copper*; found in the ſlate mountains of Rothenburg, Eiſleben, Glückſbrunnen, and Ringelſdorf.

THE following ſtones are chiefly compoſed of kernels, or pieces of different ſizes, moſtly ſmall, which are conglutinated by different ſubſtances, which are more or leſs viſible; the ſubſtances by which they are conglutinated, are either ſilic. argill. calcar. or ferugenous earth, and exhibit accordingly different degrees of hardneſs and texture; and according to the nature of the component parts, different colours.

8.

SAND STONE.

Saxum arenaceum.

Germ. *Sand ſtein.*

This ſtone is compoſed of ſmall particles of quartz, and of other ſtones; ſometimes it contains micaceous particles. The different ſubſtances

ſtances of which it is compoſed, are conglutinated by *clay*, *lime*, or *oxyd of iron*, or by an unknown glutinous ſubſtance, to which the coherence of particles forming whole mountains, muſt be aſcribed; the ſand-ſtone is found of various colours, browniſh red, greyiſh white, greeniſh grey, white and reddiſh brown, ſometimes containing kernels of *feldſpar* and *micaceous ſhiſtus*, of *flint*, of *mica*, and ſometimes a little *cinnabar*.

It contains accidentally extraneous foſſils, ſuch as *echinits*, *pectinits*, *aſteria*, &c.

Its texture is ſometimes very compact, and the particles hardly diſtinguiſhable; other kinds have a granulated texture; it is found of different degrees of hardneſs, ſometimes ſoft and friable; it hardens when expoſed to air; and certain kinds are ſo hard as to ſtrike fire with ſteel; other kinds are porous, and admit the water paſſing through, and that kind is uſed for filtering water. It is found in Mexico and Germany. The ſand ſtones are employed in common life for various purpoſes, according to their nature and degrees of hardneſs; for inſtance, when they admit to be cut, and do not abſorb water, they are uſed for building, and when they are of a fine texture, and leſs hard, they are uſed for common grinding ſtones; and when

when they are unalterable in fire, they are used for building the inside of melting furnaces; when they are hard and compact, they are used for mill-stones; the hardest kind serves for the foundation of bridges; certain kinds are decomposed by air, particularly such as are found near the sea; some of these contain saline particles; are porous, absorb water, which, when exposed to cold air, occasions them to crack; they are therefore not proper for building.

The common sand-stone, in which the particles are conglutinated by siliceous matter, contains occasionally kernels of feldspar, micaceous shistus, flint, mica, and cinnabar, sometimes also extraneous fossils, as *echinites, turbinites, asteria.*

The other kind of sand-stone, in which the particles are cemented by a substance of argillaceous nature, contains occasionally *calcareous spar, flint, argillaceous shistus, quartz,* impressions of plants, also *echinites,* &c.

Another kind in which the cement is ferugenous earth, exhibits a red colour, and contains at times, *turbinites, histerolites.*

The *grey wacke* is also a sand-stone composed of *quartz,* and a great portion of *siliceous shistus*; sometimes also *argillaceous slate,* and *mica.* The particles are of different size, and

and generally conglutinated by a maſs of *ſlaty clay*.

It is generally compact, ſometimes has a ſlaty appearance, and contains now and then petrefactions and corals.

The two following varieties of ſand-ſtone may be particularly noticed.

VAR. I. WHET-STONE.

Saxum quotarium Wallerii.

Cronſt. *Saxum compoſitum mica, quartzo et forſan Argilla Martiali in nonnullis ſpeciebus.*

This ſtone has a ſlaty texture, and is rather ſoft; it is ſometimes mixed with *mica* and *quartz*; it may be eaſily divided into plates; is found in layers; when broken, it has a clayey appearance; is a little glittering, and exhibits generally a fine grain. The coarſer kinds of whet-ſtone are evidently compoſed of *ſiliceous ſand*, cemented by clay and lime, aſſiſted by moiſture. It contains beſides the micaceous particles, *oxyd of iron*, from which ariſes its different colour. Thoſe whet-ſtones, whoſe particles are cemented by a clayey ſubſtance, are the

the hardeſt. and are of two different qualities; one kind is of a very fine texture, and is uſed for ſetting razors; the other, which is of a coarſer texture, is uſed for grinding; both kinds ſtrike fire with ſteel; that which has a ſlaty texture, is uſed for covering houſes and walls. Thoſe whet-ſtones which are cemented by calcareous matter, have the leaſt coherency, efferveſce with acids, become harder when expoſed to air, and are ſometimes ſubſtituted for marble.

Amongſt the ſand-ſtones, there are ſome which exhibit a porous texture, and thoſe are found in Mexico and in Germany; they admit water to paſs through them, and are therefore cut into funnel ſhaped ſtones, and uſed for filtering and purifying waters. The whet-grinding—and ſand-ſtones, generally form large layers in mountains, they ſeldom indicate ores.

VAR. 2. MILL-STONE.

Waller. *Saxum Quartzo et Steatite mixtum, fiſſile.*

It is a mixture of ſmall particles of ſand, conglutinated by clay; its principal conſtituent parts are *lapis ollaris*, *micaceous ſpar*, and *micaceous*

ous quartz. Sometimes contains *red garnits,* and *white cryſtallized ſhörl.* It is uſed in corn-mills; it often indicates ores, particularly tin, and lead, ores.

PUDDINGSTONE.

Germ. *Wurmſtein.*

This conſiſts of ſmall, roundiſh, or oval pieces of *quartz, micaceous ſhiſtus,* or *flint,* which are ſometimes conglutinated by a clayey maſs; ſometimes by *jaſper* or *quartz.*

The moſt beautiful kinds are found near St. Albans, in Hertfordſhire. To the claſs of puddingſtones, belongs the ſtone called *Nagelfluhe,* by the Swiſs.

9.

COAL.

It is chiefly compoſed of inflammable matter, or indurated bitumen, mixed with earthy particles. It originates from decompoſed wood, or other vegetable ſubſtances. It is found of various colours, viz. deep blueiſh, browniſh, or iron black; when broken, it exhibits a conchoidal, ſometimes a ſlaty, lamellated, and uneven texture.

It contains ſometimes *pyrites*, *ſilver*, *manganeſe*, and alſo gangues, which contain *copper pyrites*, *galena*, *fluor*, and *calcareous ſpar*; ſometimes, though ſeldom, it contains extraneous foſſils, mytulites. The coal flötz, with regard to their ſituation, alternate with *flötz of marl*, *lime-ſtone*, *ſand-ſtone*, though ſeldom with *bituminous ſhiſtus*.

Coal flötz are often found one laying over the other, and the ſtrata are merely divided by thin layers of clay; ſometimes they are found in the ſtate of gangues; they are alſo frequently found covered with *ſand*, *clay*, *wacke*, and *baſalt*.

Coals are alſo found, containing remnants of wood, not yet decompoſed; and it has been ſuppoſed, that the tranſmutation of the wood, collected together by water, was occaſioned by water impregnated with vitriol, and that the vitriolic acid changed the reſinous and oily parts of the wood into petroleum.

It forms conſiderable flötz or ſtrata in China.

10,

10.

CHALK.

Lat. *Creta.*

The chalk flötz generally alternate with strata of flint, and are only found in the lower flat countries, particularly on the sea coast; they are found on the two opposite coasts of England and France, along the British Channel, in great quantity in the Netherlands, and in various Danish islands, particularly on Zealand and Moen, also on the islands Rügen and Candia, which has obtained from them, its present, as well as its former ancient name *Creta.* The coasts and rocks, where such flötz are found, have generally a grotesque appearance.

Respecting the question, how beds of flint have been formed in chalk flötz, Mr. Wiedeman supposes, that the flint in the chalk flötz was formed by a precipitation from the water, which is probable; chalk is often so loose, that certain parts of it are washed away by water, which occasions cavities, into which a liquid flinty mass may enter. The manner in which the nodulous pieces of flint, and the great number of echinits in the flints have been formed, has been explained by Mr. Werner in the following way: He says, that after the flötz strata, precipitated from water, had begun to harden, air had been extricated, which endeavoured to penetrate through the soft mass of chalk, but not having sufficient expansive power to break through, remained therefore incarcerated and formed thus larger or smaller cavities, in proportion to the quantity of air which was extricated. But when the chalk gradually dried, it cracked in different parts, the incarcerated air escaped, and left empty cavities, into which the liquid mass of flint, which formed the upper part, entered, and covered, or encircled the shells or echinits, which, during their decomposition, may also have produced gases, and thus contributed to the formation of the cavities. And as the liquid flinty mass possessed a greater degree of cohesion, than the loose chalk, it was natural to expect, that at those places, where the flinty mass and the chalk came in contact by entering through the small fissures, more or less particles of chalk, in proportion to the different degrees of liquidity of the flint mass, and compactedness of the chalk, had combined with the liquid flint mass, and had thus entered in a greater or less degree into

into its compoſition; and thus he explained the formation or origin of the nodulous pieces of flint, and the petrified echinits, which frequently occur in chalk flötz, and alſo the incruſtations of chalk, and the different degrees of purity of flint which often efferveſces with acids, which Mr. Gerhard conſiders as occaſioned by a tranſmutation of the chalk.

11.

Rock Salt.

This ſubſtance ſeldom forms whole mountains; it generally occupies certain parts of flotz mountains of the later formation, which only occur in flat countries. It is found in Gallicia, Hungaria, &c. in Poland and Tranſylvania; it forms large maſſes, of an extent of 120 German miles long, and 22 broad.

12.

Gypsum.

This ſubſtance forms a peculiar kind of flötz mountains; it is met with either under *lime* and *ſand ſtone*, or under *loame* and *ſand*. It is ſometimes found placed in alternate order with *lime-ſtone*, *ſand-ſtone*, *marl*, or *clay flötz*.

13.

Ferruginous Clay Flötz.

1. *Common argillaceous iron-ſtone:*

2. *Bituminous ſhiſtus.*

The principal maſs of the ferruginous clayey ſtrata, is the argillaceous iron-ſtone, which with regard to its ſituation, alternates with ſtrata of clay, and bituminous ſhiſtus, ſeldom with ſand-ſtone. In this ſtate it is found at Weraw, in Upper Lauſatia; near Tarnowitz, in Upper Sileſia, &c.

14.

Calamine.

Lat. *Lapis Calaminaris.*

This ſubſtance alſo forms flötz or ſtrata, containing occaſionally *galena*, which is found near Olkuſz, Boleſlaw, Ligota, &c. in the Cracowien mountains.

DIVISION III.

Products or component parts of the ALLUVIAL MOUNTAINS.

1.

Tuff Stein *by the Germans.*

This ſtone conſiſts of *calcareous* and *argillaceous earth,* and now and then of *ſand* and *oxyd of iron.*

It

It is found white, grey, and alſo yellowiſh grey. It is ſeldom found compact, generally porous, and often occurs in the ſtate of incruſtation; ſometimes it conſtitutes the cement of *ſand ſtone*, and *flötz-lime*, *porphyry*, &c. It forms that kind of foſſil, which is called *conglomerate*, and contains frequently river and ſea ſhells, impreſſions of weeds and leaves, alſo bones and teeth of various animals. It is found particularly on the banks of rivers, in ſeparate incoherent pieces.

2.

Bituminous Wood.

This ſubſtance occurs alſo occaſionally in the alluvian mountains, though the greateſt quantity of it is found in flötz mountains.

3.

Loam.

Germ. *Laimen.*

This is a mixture of lime and ſand; it effervesces with acids, and melts eaſily in the fire; Mr. *Vogt* is of opinion, that the loams originate from decompoſed or mouldered ſtones, which have been gathered on places which were formerly occupied by the ſea; ſuch may be ſeen in the country betwixt Weiſſenfels and Leipſic, alſo near Querfurt, where it forms large beds. Sometimes it is apparently divided by layers of *coarſe ſand*, *quartz*, and *hornſtone*; it alſo contains ſometimes kidney-ſhaped *iron ſtone*.Germ. *Eiſennieren.*

4.

SAND.

This conſiſts of diſtinct kernels or grains, which are rough to the touch, and cannot be ſoftened, nor penetrated by water, nor by any acid, except the fluoric.

a. Quick ſand.

Germ. *Quel ſand.*

This conſiſts of pure, colourleſs, ſemitranſparent, round, or angular quartz grains. It is found in the ſea, on ſhores, and along coaſts; it is alſo thrown out of ſprings.

b. Duſt ſand.

Germ. *Flug ſand. (Flying ſand.)*

This

This consists of sand-like particles, so fine as to be scattered about by the wind.

c. Common sand.

Germ. *Gemeiner sand. Heyde Sand.*

Which is found on places called commons or heaths. This is a mixture of grains of *feldspar* of various sizes.

It originates from decomposed granit, to which also belongs the grits.

5.

Potters Clay.

This substance is not only found in Alluvial, but also in flötz-mountains.

Products of the alluvial mountains.

a. Marshy iron ore.
b. Aluminous earth.
c. Turf.

Turf is a substance composed of the combustible parts of vegetables, impregnated with bitumen. The following varieties are known.

The

The pitch Turf.
Moor Turf.
Moss Turf.
Heath Turf, &c.

To the alluvial mountains may be added the division of such, as are called in Germany, Seifengebürge, (fil. soap mountains) valley mountains, which exhibit irregular masses of *granit* and *gneiss*; which are mixed with *clay*, and from which, *tin*, *gold* and *cinnabar* are occasionally separated by steam works. They are generally found in deep extensive valleys.

DIVISION IV.

VOLCANIC PRODUCTS,

May be divided into

1. Primordial products, or such as existed before volcanic fire, and which were thrown out in an unaltered state, by the elasticity of the circumambient air; as *coals*, certain kinds of *basalt*, *amygdalordes*, *sand stone*, *micaceous shistus*, *sienit*, *granit*, *quartz*, *feldspar*, *zeolithe*, *shörl*, *hornblende*, *porphyre shistus*, *olivin*, *mica*, *agath*, *marl*, *lime stone*, *calcareons spar*, *swine stone*, and *leazit*.

2. Into

2. Into volcanic products, or ſuch as have been altered by ſubterraneous fire, and thrown out of the crater.

A. Lava.

The lavas ſeem to be nothing more than baſalt, which has undergone different degrees of fuſion.

a. *Lava Slag.*

Waller. *Porus igneus lapideus, facie terreſtri aut ſcoriacea.*

Born. Catal. Raiſ. *Lave ſpongieuſe.*

Lat. *Scoria ſpongioſa.*

This ſubſtance which appears like a hard, heavy, vitreous ſlag, iſſues from mount Veſuvius, like a foam; on cooling, its ſurface becomes uneven, veſicular, and full of holes; ſometimes it takes an undulated appearance. There are lavas which originate from *clayey ſtones*, and others which originate from *porphyre*, which have undergone a certain degree of fuſion. One kind of lava is compact, and contains often *mica* and *garnit-coloured ſhörl cryſtals.* This kind, found at mount Veſuvius,

Veſuvius, takes a poliſh, and is therefore uſed for ſnuff-boxes, and ornaments, &c.

The other kind, which is ſpongy, and has a porous texture, contains *zeolithes*, *cryſtallized calcareous ſpar*, *quartz*, &c. is frequently found in Sicily, on the Lipari iſlands, and in all the *crater* of the principal volcanoes.

b. Compact opaque Lava.

This conſtitutes the lower part of the lava ſtream; it is black and brown, and reſembles baſalt.

c. Lava Glaſs.

Waller. *Porus igneus lapidus ſolidus vitreus.*

Born. Catal. Raiſ. *Verte volcanique.*

Scoria vitrea.

Germ. *Vulcaniſhes, or Lava Glaſs.*

This kind has undergone a perfect fuſion, ſo as to exhibit a perfect vitreous appearance; its colour is either black or greeniſh, very ſeldom ſemitranſparent; it is brittle, and breaks in conchoidal ſhaped angular pieces. It is frequently found near the volcanic mountains in Sicily, but

but not in ſuch great quantities as the other lava; it is alſo found in large maſſes in Iceland.

B. Pumice.

Germ. *Bimſtein.*

Lat. *Pumex.*

Which conſiſts of thin parallel fibres; they are generally white or grey, blackiſh brown, or reddiſh and yellow. It is found in the aſhes near Veſuvius, from whence it is waſhed down into the ſea. It alſo originates from the decompoſition of granit, or perhaps, baſalt.

C. Volcanic Ashes.

Are found of a white greyiſh, or yellow colour; have an earthy appearance; are frequently mixed with pumice; they are projected from Veſuvius to many miles diſtance, before they fall to the earth, and ſeem to have been produced by the decompoſition of different minerals, which have been altered, and thrown out of volcanoes. To theſe belongs alſo the porcelain earth, which is found on the heights of Puzzola, and is compoſed of *argillaceous, calcareous, ſiliceous,*

ſiliceous, and *ferugenous earth*; when expoſed to a ſtrong heat, it melts into an opaque glaſs.

Subſtances altered by ſubterraneous Fire:

Werner. *Pſeudo, volcanic products.*

To this claſs belongs the porcelain jaſper, the earthy flags reſembling lava, the bar-like argillaceous iron ſtone, and the baſalt.

ORGANIZED EARTH.

This ſubſtance originates from a decompoſition of organized bodies, which entered into the mixture of the ſtones and earths belonging to the mineral kingdom.

Its component parts are very fine, but without coheſion; it abſorbs moiſture, like the argillaceous earth, and is then ſmooth to the touch, and of a blackiſh colour. After expoſure to heat, it effervesces with acids, diſcovering calcareous earth; when expoſed to a very ſtrong heat, it melts into a greeniſh glaſs; it generally conſtitutes the ſurface of fields, and promotes the growth of plants.

VAR.

VAR. 1. VEGETABLE EARTH.

Germ. *Gewächs Erde.*

Lat. *Terra vegitabilis. Humus vegetabilis.*

This earth is found in all cultivated places, mixed with more or leſs clay, ſand, and other barren earths. It is black, and ſomewhat greaſy to the touch; is found in foreſts and gardens; it is mixed with vegetable ſubſtances, which tend to fertilize it. Field earth is dry and grey, and not ſo heavy as the garden earth, and differs in colour according to the different proportions of ferruginous, or other heterogeneous ſubſtances; it contains ſaline particles, which can be extracted by water ſimply, or by diſtillation; it yields an empyreumatic oil, and moiſture reſembling the ſpirits and oil of tartar.

VAR. 2. ANIMAL EARTH.

Germ. *Thier erde.*

Waller. *Humus animalis.*

This earth differs from vegetable earth, by its inferior gravity. It conſiſts of finer particles than the foregoing earth; its colour is white

white or aſh grey. When ſubmitted to diſtillation *per ſe*, it yields volatile alkali, but the vegetable earth yields potaſh It is generally found in church yards, and other places where the putrefaction of animal ſubſtances takes place. It ariſes from the decompoſition of aquatic animals, and is found mixed with vegetable earth, in ſtagnant waters.

END OF VOL. I.

ERRATA.

Preface. Page 8. line 18. for *Bruckman*, read *Brückman*.

—— —— 12. — 2. after *Systema Natur*, add *Linn. Edit Gmelini.*

In the Table of Contents, Page 18. line 19. leave out the words *transparent shörls*.

—— — 29. line 14. for *agerosus*, read *accrosus*.

At the tops of the pages, from 22 to 26, read *External Characters*, for *Characteristics*.—And from page 31 to 34, *Physical and Chemical Properties of Minerals*, instead of *Characteristics*.

Page 31. line 23. for *on*, read *to*.

Physical Characters. Page 33. line 4. for *attracting*, read *attract*.

Page 37. line 13. for *with*, read *by*.—And in line 9. for *to distilled water*, read *to that of distilled water*.

—— 19. for *magnesia*, read *magnesian earth*.

—— 39. — 12. for *in*, read *into*.

—— 44. — 13. for *to*, read *into*, and for *by*, read *with*.

—— 67. — 15. add after *shining* a ; and *it is*, and the ; after *texture*, is to be put after the word *broken* ;

—— 69. — 6. for *pellucidis*, read *pellucidus*.

—— 90. — 23. for *colour*, read *coloured*, and the *c* before line 28. is to be left out.

—— 92. — 11. before *arsenical*, put *viz*.

—— 108. — 19. after the word *or*, add *with*, and after *agate* a ,

—— 125. — 11. for *the*, read *its*.

—— 128. — 9. for *lidicus*, read *leidices*.

—— 140. — 22. for *product*, read *products*.

—— 146. — the last. after *argillaceous*, add *earth*.

—— 150. — 7. after *exhibit*, put a .

—— 160. — 15. after *texture*, put *is*.

—— 191. — 12. after *borax*, put a ;—and the . leave out after *heat*.

—— 193. last line. for *in*, read *near*.

—— 200. — 4. for *arbesti*, read *asbesti*, and for *ollaus*, read *ollaris*.

—— 261. — 13. for *azerosus*, read *accrosus*.

—— 268. — 19. for *astringent*, read *adstringent*.

—— 271. — 1. leave out the words *also the*.

—— 12. after *lamellar*, add *it is*.

—— 274. — 14. remove the word *and*, and put it after *kremnitz*.

—— 301. — 10. for *costic*, read *caustic*.

—— 322. — 11. for *effervesce*, read *effloresce*.

—— 330. — 14. for *remnants*, read *remainings*.

—— 338. — 21. for *amygdaloides*, read *amygdaloides*.